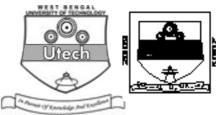
INDUSTRIAL INSTRUMENTATION – I (SEMESTER - 4)

CS/B.TECH (EIE-NEW)/SEM-4/EI-403/09



1.	Signature of Invigilator							di di	200		Gin	- CE	- \	♣ <u>•</u> •••	→
2.	Reg. No Signature of the Officer-in-Charge).													
	Roll No. of the Candidate														
	CS/B.TECH (EI ENGINEERING & MANAGI	ЕМЕ	NT	EX	AM	INA	TIO	NS	, JI	UNI					

Time: 3 Hours] Full Marks: 70

INSTRUCTIONS TO THE CANDIDATES:

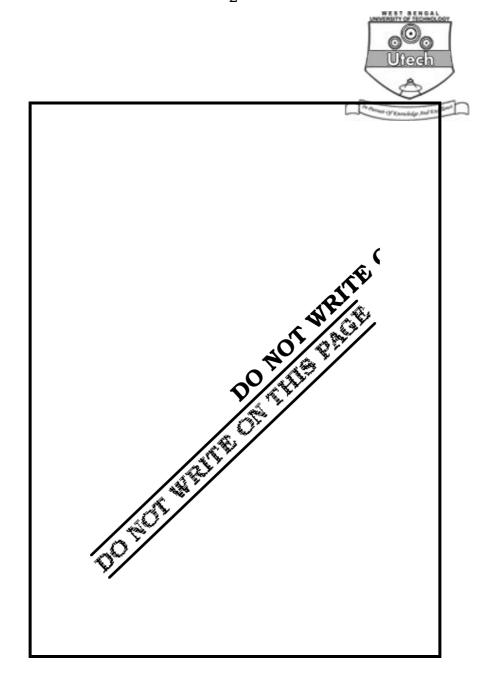
- This Booklet is a Question-cum-Answer Booklet. The Booklet consists of 32 pages. The questions of this concerned subject commence from Page No. 3.
- 2. In Group - A, Questions are of Multiple Choice type. You have to write the correct choice in the box provided against each question.
 - For Groups B & C you have to answer the questions in the space provided marked 'Answer b) Sheet'. Questions of Group - B are Short answer type. Questions of Group - C are Long answer type. Write on both sides of the paper.
- Fill in your Roll No. in the box provided as in your Admit Card before answering the questions. 3
- Read the instructions given inside carefully before answering. 4.
- 5. You should not forget to write the corresponding question numbers while answering.
- 6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- 7. Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.
- You should return the booklet to the invigilator at the end of the examination and should not take any 8. page of this booklet with you outside the examination hall, which will lead to disqualification.
- Rough work, if necessary is to be done in this booklet only and cross it through. 9.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY Marks Obtained Group - A Group - B Group - C Question Examiner's Total Signature Marks Number Marks Obtained

Head-Examiner	/Co-Ordinator	/Scrutineer





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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE 2009 INDUSTRIAL INSTRUMENTATIO **SEMESTER - 4**

Time: 3 Hours] [Full Marks: 70

GROUP - A

			(Multiple Choice '	Туре 🤇	Juestions)
l.	Cho	ose th	e correct alternatives for any <i>te</i>	n of th	e following: $10 \times 1 = 10$
	i)	Dun	nmy strain gauge is used to		
		a)	increase the efficiency		
		b)	increase the range		
		c)	compensate for temperature c	hanges	8
		d)	make the bridge self-balancing	g.	
	ii)	Trar	nsducer for measurement of rota	ational	displacement is
		a)	shaft encoder	b)	differential capacitor
		c)	LVDT	d)	strain gauge.
	iii)				has a damping factor of 0.8 . It is pitude. It has reasonant peak of
		a)	108%	b)	92%
		c)	20%	d)	it has no resonance peak.
	iv)	mou two	inted on the top of the cantileve	er and	strain in a cantilever. One gauge is the other is placed at the bottom. The tage sensitive Wheatstone bridge. This
		a)	a quarter bridge	b)	a half bridge
		c)	a full bridge	d)	a null bridge.

CS/B.TECH (EIE-NEW)/SEM-4/EI-403/09

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v)	A 0	- 10A ammeter is guaranteed	for 2%	accuracy for full scale reading	ng. What
	will	be the percentage limiting error	when		
	a)	4%	b)	1% Utech	
	c)	5%	d)	10%.	
vi)	Stat	istical analysis of measurement	data a	re done to reduce	
	a)	offset error	b)	gross error	
	c)	random error	d)	relative error.	
vii)	The	main source of error in an acce	elerome	eter is the presence of	
	a)	gravitational force	b)	electromagnetic force	
	c)	centrifugal force	d)	all of these.	
viii)	MTI	TF stands for			
	a)	maximum time to fail	b)	minimum time to fail	
	c)	mean time to fail	d)	mean time between failures.	
ix)	The	measurement of mass flow-rate	e in we	ighfeeder is independent of	
	a)	belt slip	b)	belt stiffness	
	c)	materials in feed hopper	d)	alignments of the idlers.	
x)		measured value of a resistandatis the absolute error?	ces 11	1 Ω whereas its true value is	s 110 Ω.
	a)	1 Ω	b)	1%	
	c)	10 Ω	d)	11 Ω .	
xi)	Pne	umatic relays are not used to pe	erform		
	a)	arithmetic operation	b)	logarithmic operation	
	c)	boosting of input signal	d)	integration.	
xii)	Whi	ch arera is classified by 'Grain e	elevato	rs'?	
	a)	Class I	b)	Class II	
	c)	Class III	d)	None of these.	



5 **GROUP – B**

(Short Answer Type Questions)

Answer any three of the following questions

 $3 \times 5 = 15$

- 2. Discuss each type of Systematic Error as classified, giving suitable examples. Explain the measures taken to minimize these errors.
- 3. What are the different standard inputs given to the measuring system for evaluation of its parameters? Derive the equation and curve for time response of a first order system when subjected to unit step input. 1 + 4
- 4. a) Write down a mathematical expression for 'standard deviation', explaining all the terms used therein.
 - b) A large number of 230 Ω resistors are obtained by combining 120 Ω resistors with a standard deviation of 4·0 Ω and 110 Ω resistors with a standard deviation of 3·0 Ω . What is the standard deviation of 230 Ω resistors thus formed?
- 5. What do optical absolute encoders usually generate a gray coded binary coded output? Distinguish between absolute rotary encoder an incremental encoder. 3 + 2
- 6. What is a pneumatic relay? Describe with a neat sketch, the bleed type pneumatic relay. 1+4

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following questions.

 $3 \times 15 = 45$

- 7. a) What is Gaussian distribution?
 - b) What are the properties of Gaussian distribution?
 - c) Successive measure of 1 kg each (of high accuracy) were added at the hook at the lower end of a vertically hanging wire. The position of a mark at the lower end was measured using an ordinary scale. The following results are obtained:

Load X in kg	1	2	3	4	5	6	7	8	9	10
Position of Mark Y	6.05	6.20	6.25	6.35	6.40	6.50	6.55	6.60	6.70	6.75

Determine the equation of the best fitting straight line using the method of sequential difference.

d) What are the criteria for goodness of fit?

2 + 3 + 7 + 3



- 8. a) Show that in a seismic accelerometer the amplitude of the relative displacement between the proof mass and the spring-damper assembly varies linearly with the acceleration.
 - b) The seismic mass of a spring-mass accelerometer is 50 g and the spring constant is 5000 N/m. The amplitude of the relative displacement is \pm 2 cm. If $\zeta = 0.7$ and $\omega / \omega_n < 0.4$, where symbols have their usual meaning, calculate
 - i) the maximum measurable acceleration in g where g is the acceleration due to gravity, and
 - ii) the natural frequency of oscillation of the system.
 - c) Four strain gauges are used to measure the torque of a cylindrical shaft.
 - i) Draw a labelled diagram showing the arrangement of gauges on the shaft and the bridge configuration.
 - ii) Calculate the maximum bridge output for a strain of 500×10^{-6} . The gauges have resistance of $120~\Omega$ each, and a gauge factor of $2\cdot 1$. The maximum permissible gauge current is 50~mA. 4+(3+3)+(2+3)
- 9. What is mass flow-rate? What is basic difference between a belt weighing system and a weighfeeder? What is weigh length of a belt weighing system? Explain the principle of operation of a weighfeeder with a schematic representation. Explain how bridge circuit is used for multiplication of two signals from load-cell and tacho-generator in weighfeeder? 1 + 2 + 1 + 7 + 4
- 10. a) Draw a basic Zener-barrier circuit used in a hazardous are to limit the amount of electrical energy produced under any possible fault condition and explain its mode of operation.

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- b) Figure shows an equivalent circuit of a Zener-barrier used for the measurement of temperature by a thermocouple in a hydrogen-air atmosphere. The symbols used for the sensor, cable network and the Zener-barrier are self-explanatory. If $V_z=10~\rm V,~R_1=50~\Omega$, $C=1.85~nF,~L=60~\mu H$ and the minimum ignition energy for hydrogen-air is 19 $\mu \rm J$, examine from the calculation of maximum total energy stored in the circuit if the instrumentation is safe or not.
- c) i) List the advantages of a 4 20 mA two-wire live zero loop.
 - ii) What is its disadvantage when used to interconnect, say, chart recorders? 5+5+(3+2)
- 11. a) What is the working principle of Stroboscope?
 - b) What do you mean by proximity measurement? Describe the working principle of a magnetic proximity sensor?
 - c) Describe the working principle and derive the necessary expression of a seismic displacement transducer. 4 + 2 + 3 + 6

END