BITS, PILANI - DUBAI CAMPUS, KNOWLEDGE VILLAGE, DUBAI
III YEAR - EIE, SECOND SEMESTER 2004-2005

INSTR UC 355 - ELECTRONIC INSTRUMENTS AND INSTRUMENTATION TECHNOLOGY

COMPREHENSIVE EXAMINATION (CLOSED BOOK)

Maximum Marks: 120
Time: 3 hours

Date: 24-05-05

PART A (10 X 3 Marks = 30 Marks)
Answer All the Questions

1. A current $i = 0.8 + 0.5 \sin\omega t - 0.3 \sin 2\omega t$ is passed through the circuit shown in figure -1. M_1 is a PMMC type current meter with negligible resistance and M_2 is a true RMS reading voltmeter with large resistance .Determine the reading of each meter at $\omega = 10^6$ rad/sec

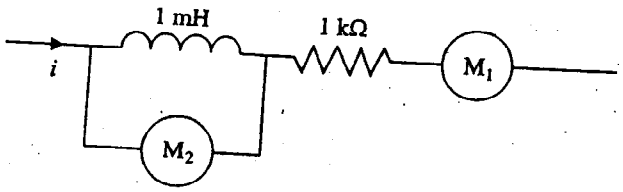

Figure -1

2. Find the output of a 4 bit successive approximation A/ D converter to a 3.237 V input, if the reference is 5V. Explain the steps involved in the conversion process.
3. How will you use Anderson loop for the measurement of micro strain of a resistive strain gauge, with gauge factor of G
4. Which oscillator is used to generate a wave form of high frequency stability and which has very high quality factor .Justify your answer.
5. Explain with the block diagram, the principle of operation of a electronic instrument which is used to measure each harmonic component individually of a given signal
6. What is Electro Static Discharge? What are the sources of Electro Static Discharge?
7. What are the factors that will affect the reliability of the product .Explain the bath tub curve?
8. List out the 5 interface management lines of IEEE 488. What is the need of it
9. Which graphic recorder is used to record the relation between two variables? Explain the principle of operation.
10. What is the acronym of HART. Briefly explain the HART field communication protocol

PART – B (9 X 10 Marks)
Answer any 9 Questions

11 A certain 3 1/2 digit DVM has an accuracy specification of ± 0.5 % of reading ± 2 digits
(a) What is the percentage error in volts when the instrument is reading 5.00 V on its 10 V range
(b) What is the possible error in volt when reading 0.10 on 10 V range?
(c) What % of reading is the possible error in the case of (a) and (b)

12 For an inverted Wein bridge shown in figure – 2 ,R_4 and C_4 are unknown. $R_1 = 1008 \pm 0.5\Omega$ and $R_3 = 2002 \pm 0.5\Omega$. At the balance point , $R_2 = 1080 \pm 5\Omega$ and $C_2 = 190 \pm 0.5$nF. Calculate
(a) R_4 and C_4
(b) The fractional uncertainties in the values of R_4 and C_4

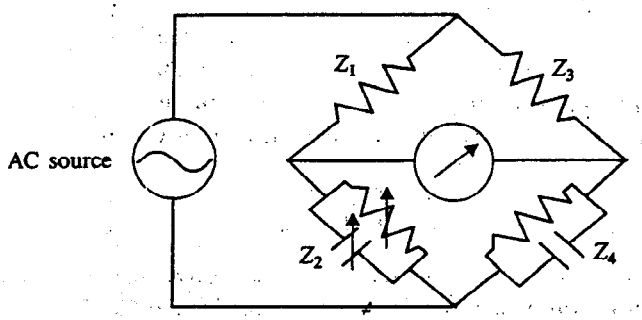

Figure – 2

13 Explain the following in detail
(a) OSI network model
(b) The blue tooth technology and its features

14 With the circuit diagram explain the intrinsically safe interconnection of the following sensors/devices installed in an hazardous area with the control room in a non – hazardous area
(a) 4 – 20 mA transmitter
(b) Three – wire RTD
(c) LED Pilot light

15 If BITS, Pilani -Dubai campus is to go for ISO 9001 certification, what are the various elements required for implementing the system ? Explain any five elements

16 Explain with the block diagram, the working principle of digital phosphor oscilloscope. Differentiate the above between analog and DSO

17 A gating period of 1 ms, 10 ms, 100 ms, 1s, and 10s are provided on a digital counter, time - frequency meter having a 3 digit display. A gating period of 10 ms is selected to measure an unknown frequency and a reading of 025 is obtained. What is the likely value of frequency? What step is taken to obtain more accuracy? Justify your answer in detail.

18 (a)What are the advantages of twisted pair cables? Explain a typical thermocouple wiring arrangement with the termination cabinet using twisted pair cables

(b) show the various echelons for the traceability of accuracies in electronics measurement under the national calibration policy

19 Draw the output waveform of the circuit, if a triangular wave forms of amplitude 20 volts is applied to it. Design the values of R_1, R_2, R_3 and the value of the V in order to get a voltage $V_1 = 2.5$ V and $V_2 = 5$ V .Explain the operation of the circuit with the designed parameters.

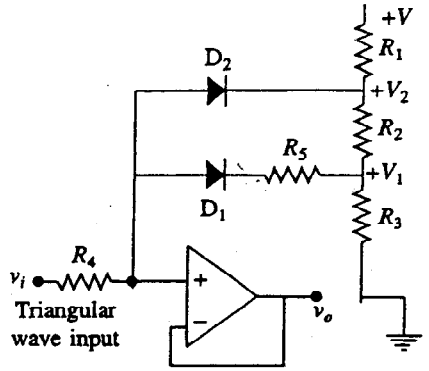

Figure – 3

20 Piping and Instrument diagram for a chemical process is shown in figure – 4. Explain the process in detail. List out the process line symbols and process elements shown in figure – 4

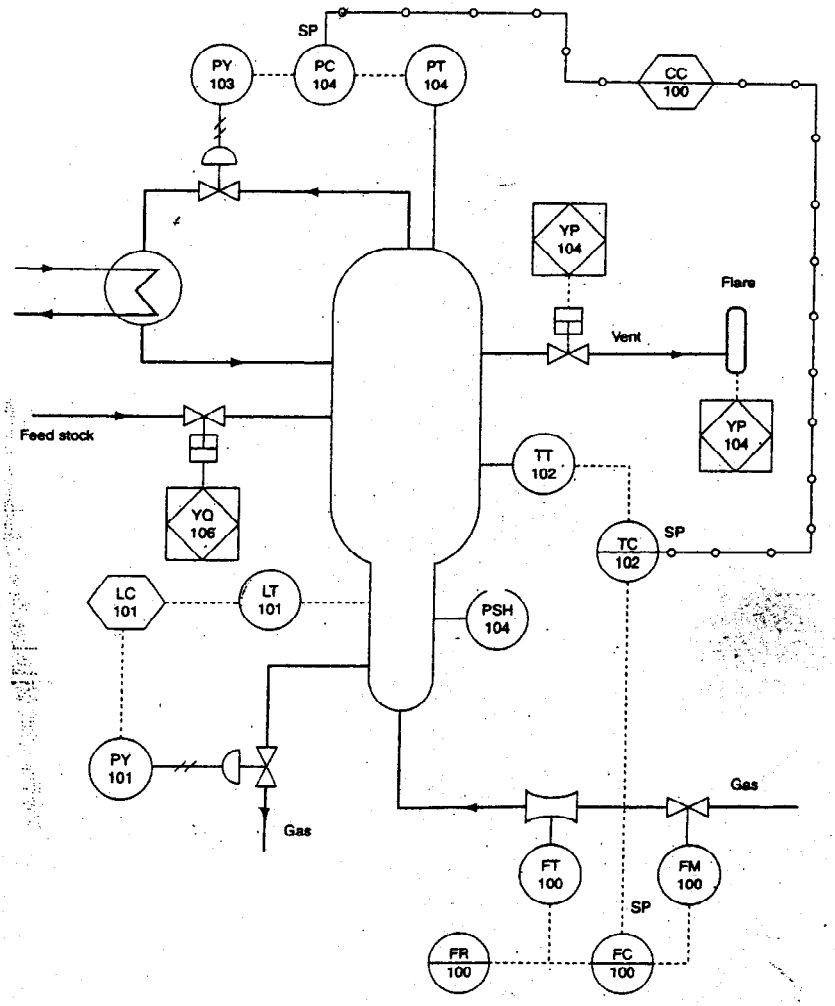

Figure – 4

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INSTR UC 355 - ELECTRONIC INSTRUMENTS AND INSTRUMENTATION TECHNOL

TEST-2(OPEN BOOK)

Maximum Marks: 30
Time: 50 Minutes

Date: 08-05-05

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1. Design a circuit to generate triangular waveform of amplitude 5V and a frequency of 1 Hz from a square wave of amplitude 10V with the same frequency

2. Explain with the block diagram a device which will measure the asymmetrical distortion produced by the interaction of two or more signals passing through a device simultaneously

3 Design a programmable decade indirect synthesizer to generate 3.52 KHz from 1 KHz reference frequency

4 Explain with the block diagram ,the electronic counter used for the measurement of phase angle between the two sinusoidal signal of same frequency

5 A plot of land has measured dimensions of 50 m X 150m. The uncertainty in the 50 m dimension is ± 0.01 m. calculate the uncertainty with which the 150 m dimension must be measured to ensure that the total uncertainty in the area is $\pm 3\ m^2$

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INSTR UC 355 - ELECTRONIC INSTRUMENTS AND INSTRUMENTATION TECHNOLOGY
TEST-1 (CLOSED BOOK)

Maximum Marks: 50
Time: 50 Min

Date: 27- 03- 2005
Weightage : 20%

1. An AC meter designed to read sinusoidal wave form is used to measure square waveform. What will be error in the reading? Suggest a different meter which can be used to overcome the above problem. [2]

2. The voltmeter shown in figure – 1 uses a 1 mA meter movement with an internal resistance of 100 Ω. The shunt resistance R_{sh}, across the movement is 400 Ω. Diodes D_1 and D_2 each have a forward resistance of 100Ω , zero cut in voltage and infinite reverse resistance . calculate the value of series resistor R_1,R_2 and R_3 if the meter rms ranges are 10 V , 50 V and 100V respectively [4]

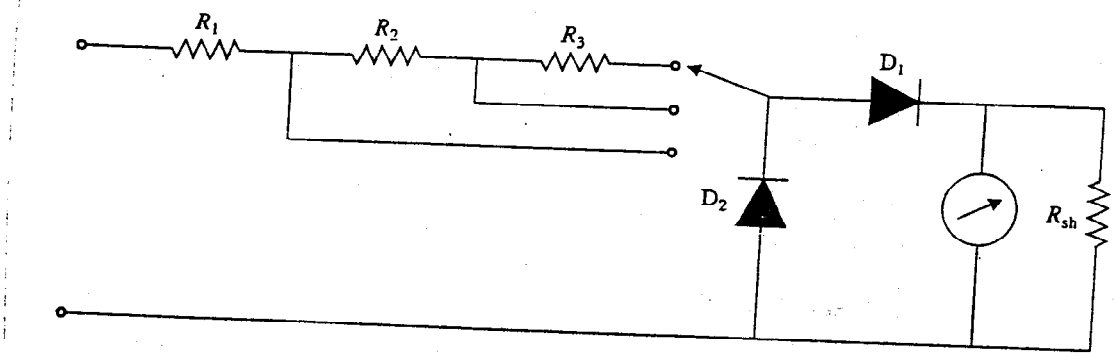

Figure – 1

3. Explain the working of a first order 1 bit modulator circuit used in sigma delta analog to digital converter. If an input voltage of 1.5 V is applied to the modulator what will be the bit stream you will get after 8 cycles of conversion process. V_{ref} is ± 2.5 V [4]

4. Explain the four wire remote sensing used in digital Multimeters [3]

5. A wheat stone bridge comprises of two fixed resistor each of value 120Ω, one active gauge and an unstrained temperature compensation gauge .two gauges are unstrained resistance of 120Ω and gauge factor of 2.2. Find the bridge out put voltage for the supply of 3V, when the active gauge is subjected to the stain of 600 micro strains. [3]

6. With the block diagram explain the working principle CRO which is used beyond 50 MHZ to 10 GHz. [4]