

BITS, PILANI - DUBAI CAMPUS, KNOWLEDGE VILLAGE, DUBAI
III YEAR - EIE, SECOND SEMESTER 2003-2004

INSTR UC 355- ELECTRONIC INSTRUMENTS AND INSTRUMENTATION
TECHNOLOGY

COMPREHENSIVE EXAMINATION (CLOSED BOOK)

Maximum Marks: 100

Date: 10.06.2004

Time: 3 Hours

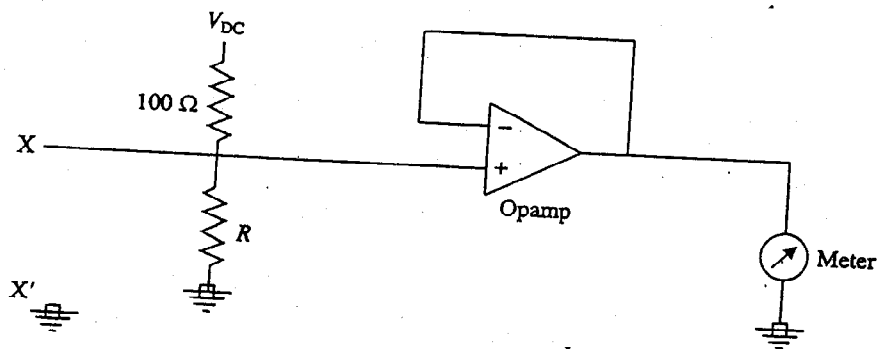
PART -A (10 X 2 Marks= 20)

Answer All the Questions

1. A basic DC ammeter circuit uses a PMMC meter movement of 1mA, $100\ \Omega$ internal resistance and an external shunt of $1.01\ \Omega$. What is the range of current the circuit can measure
2. A control valve has a linear variation of opening as the input voltage varies from 0 to 10 V. A microcomputer outputs an 8-bit output word to control valve opening using an 8 bit D/A converter to generate the valve voltage. Find the reference voltage required to obtain full valve opening (10V)
3. The schering bridge is balanced under the following conditions: $R_1=10\ \text{k}\Omega$, $R_2=1\ \text{k}\Omega$, $C_1=100\ \text{pF}$ and $C_3=400\ \text{pF}$. The bridge is driven by a 1 kHz sinusoidal source. Calculate the value of R_s and C_s
4. The chart speed of a recording instrument is 50 mm/s. One cycle of the signal being recorded extends over 5mm (time base). Calculate the frequency of the signal
5. Two resistors R_1 and R_2 are connected in series. The values of resistances are $R_1=100 \pm 0.1\ \Omega$, $R_2=50 \pm 0.003\ \Omega$. Calculate the uncertainty in the combined resistance
6. Define THD+n and SINAD in connection with harmonic distortion
7. List out any four specifications of RS 232
8. Define a field bus. Draw the block diagram representation of it
9. What is Ex representation scheme? Explain the hazardous area and equipment protection reference scheme
10. What is meant by Q - base and E - base? Explain its representation.

PART -B (8 X 10 Marks= 80)
Answer any 8 Questions

11. If BITS Pilani- Dubai campus is to go for ISO 9001 certification. Explain any five elements required for implementing the system.
12. Draw the block diagram and explain the operation of a direct analog synthesizer to generate output between 1 and 89 MHz . Given clock of 10 MHz
13. What are the methods used to protect circuits from ESD? Explain any one method. What precautions should be taken to make work area less prone to ESD
14. What is GPIB? Explain how it will communicate with other GPIB devices. Explain how the data is read in this case with the help of timing diagram?
15. Explain the architecture of foundation field bus in detail.
16. What is meant by intrinsically safe barrier? How does it provide safety? What type of barriers are used ?
17. For the given basic electronic ohmmeter circuit, assume a meter movement with $500\mu\text{A}$ full scale deflection current and $2\text{ k}\Omega$ internal resistance . The unknown resistance is connected across terminal XX'. Calculate the value of VDC and R, so that the half scale deflection reading corresponds to 75Ω . Consider the operational amplifier as ideal



18. (a) A high impedance probe with 9 MHz resistance and 4 pF capacitance is connected to an oscilloscope with an input resistance of $1\text{ M}\Omega$. The effective capacitance is decreased to 3.6 pF when the probe was connected . What is the capacitance of the oscilloscope alone?
- (b) An Astable multivibrator uses resistance of $100\text{ k}\Omega$ and a capacitance $0.01\mu\text{F}$. What is the frequency of square wave generated.
19. A $160 \pm 10\%$ pF capacitor, an inductor of $160 \pm 10\%$ μH and a resistor of $1200 \pm 10\%$ Ω are connected in series . Compute the resonant frequency of the combination, the percentage error
20. Draw the flow chart showing the decision making process based upon the interrelationship of design , production and economics. Explain in detail.

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MAKE UP FOR TEST-2 (OPEN BOOK)

Maximum Marks: 50

Time: 50 minutes

1. Design a wein bridge oscillator using operational amplifier to produce a frequency of 8 KHz [7]
2. Pressure, level, temperature and flow are the four variables of a process, which has to be monitored and recorded . Suggest a system with the block diagram for the above. [7]
3. Compare frequency versus amplitude and time versus amplitude plotter. Explain how a single device is used to plot the above mentioned response [7]
4. What are the advantages of ISO 9001:2000 standard over the 1994 standard? Explain with an example . [7]
5. Explain in detail the block diagram of logic analyzer [7]
6. Determine a circuit which is used to measure the difference in time between the transmitted and received signal of a trans receiver system [7]
7. A plot of land has measured dimensions of 50 by 150 m. 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 not greater than 150 percent of that value it would have if 150 m dimension was exact [8]

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7. A plot of land has measured dimensions of 50 by 150 m. 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 not greater than 150 percent of that value it would have if 150 m dimension was exact [8]

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TEST-2(OPEN BOOK)

Maximum Marks: 50

Date: 16.05.2004

Time: 50 minutes

1. Explain in detail the device, which is used to measure the undesired effect produced by the multiple frequencies at the other frequencies [5]
2. Design a fast switching synthesizer to get the frequency from 10.000 MHz to 10.999 MHz [10]
3. A 4 dial decade box has decade 'A' of $10 \times 1000 \Omega \pm 0.1 \%$, decade 'B' of $10 \times 100 \Omega \pm 0.1 \%$, decade 'C' of $10 \times 10 \Omega \pm 0.5 \%$, decade 'D' of $10 \times 1 \Omega \pm 1.0 \%$. If it is set at 7639 Ω . Find the percentage limiting error and the range of resistance value [10]
4. Which protocol is used to communicate with the intelligent measurement and control instruments which is traditionally communicate with 4 – 20 mA . Explain how it is used [5]
5. What is meant by morphology? With an example list out the series of steps involved [6]
6. What are the 5 lines of the general interface (parallel) management group, which communicate between the controller and the other instrument interface [5]
7. (a) Define image frequency. How is it eliminated? [3]
(b) What is the need of start/stop interpolator, where it is used? Explain in detail [3]
(c) Define interoperability. Which system offers this facility? Explain in detail [3]

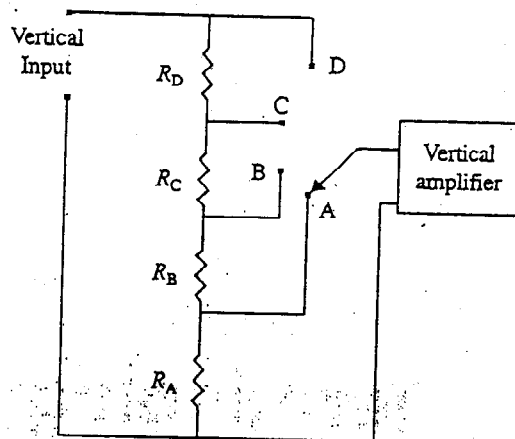
BITS, PILANI -DUBAI CAMPUS, KNOWLEDGE VILLAGE, DUBAI
III EIE SECOND SEMESTER – 2003 –2004
INSTR UC 355 - Electronic Instruments and Instrumentation Technology

MAKE UP FOR TEST – 1

MAX. MARKS : 20
DURATION : 50 MIN

WEIGHTAGE : 20%

1. An oscilloscope is to have a vertical input resistance of $8\text{ M}\Omega$, a sensitivity of 50 mV and attenuation factors of 4, 10 and 40. Compute the values of attenuating resistors R_A , R_B , R_C and R_D . Ignore input resistance of the vertical amplifier [4]



2. Explain the construction and operation of True RMS voltmeter [3]
3. Which bridge circuit is used to measure self-inductance in terms of standard capacitor? Justify your answer with diagram and derive the expressions [3]
4. Draw the block diagram of Dual trace digital storage oscilloscope [3]
5. A high impedance probe with $9\text{ M}\Omega$ resistance and 4 pF capacitance is connected to an oscilloscope with an input resistance of $1\text{ M}\Omega$. When the probe was connected the effective capacitance decreased to 3.6 pF . Find the capacitance of oscilloscope alone and the total input resistance [4]
6. How can the temperature compensation can be achieved in a permanent magnet moving coil mechanism [3]

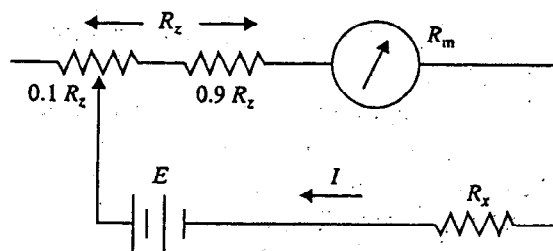
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III EIE SECOND SEMESTER – 2003 –2004
INSTR UC 355 - Electronic Instruments and Instrumentation Technology

TEST – 1

DATE : 04 /04/2004
DURATION : 50 MIN

MAX. MARKS : 20
WEIGHTAGE : 20%

1. Find the ratio of the current I (in the presence of unknown resistance R_x) to the full scale deflection current I_{fsd} for the circuit of a basic series type ohmmeter [2]



2. The quality factor Q of a coil is ≥ 10 . Suggest a bridge to measure the values of inductor and series resistance. Express these values in terms of Q . [3]
3. A dual slope type DVM has an integrator, which contain $100\text{ k}\Omega$ and $1\text{ }\mu\text{f}$ capacitor. If the voltage applied to integrator input is 1 V , what voltage will be present at the output of the integrator after 1 sec ? If a reference voltage is applied to the integrator input at time t_1 is 5 V in amplitude, what is the time interval of t_2 . [3]
4. Design a 80 dB , $500\text{ }\Omega$ attenuator using T attenuators. [3]
5. With neat sketch explain the block diagram of digital multimeter [3]
6. An electronic instrument is used to examine very fast signals. Explain its principle of operation with diagram [3]
7. Explain the design of probes with a very high Common Mode Rejection Ratio [3]

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INSTR UC 355 - ELECTRONIC INSTRUMENTS AND INSTRUMENTATION TECHNOLOGY

QUIZ -1 (CLOSED BOOK)

Maximum Marks: 20

Date: 24.03.2004

Time: 30 minutes

WEIGHTAGE: 5 %

1. Basic DC PMMC Instrument has
 - (a) A nonlinear scale marking
 - (b) The deflection torque is directly proportional to the coil current
 - (c) The conductive spring is used to provide deflecting torque
 - (d) None of the above
2. Which is the false statement in connection with the temperature compensation in PMMC meter
 - (a) Compensation can be accomplished by connecting swamping resistors in parallel with moving coil
 - (b) Compensation can be accomplished by connecting series and shunt resistors of copper and manganin
 - (c) Un compensated meter read low for rise in temperature
 - (d) None of the above
3. A 1 mA meter movement with an internal resistance of $200\ \Omega$ is to be converted in to a 0 – 100 mA ammeter . The value of shunt resistance required is
 - (a) $1.01\ \Omega$
 - (b) $2.02\ \Omega$
 - (c) $9.9\ k\ \Omega$
 - (d) None of the above
4. Which is the false statement
 - (a) Low sensitivity meter may give correct reading when measuring voltages in low resistance circuits
 - (b) Accuracy is always required in instruments. Sensitivity is needed only in some application
 - (c) High sensitivity meter give more reliable reading when voltage measurement are made in high resistance circuits
 - (d) None of the above
5. In series type ohmmeter
 - (a) Zero is marked on the left hand side of the scale. While infinity is on the right hand side
 - (b) Zero is marked on the right hand side of the scale. While infinity is on the left hand side
 - (c) Zero marking in the middle of the scale
 - (d) None of the above

6. Which is the false statement in connection with the true RMS voltmeter

- (a) Used for the measurement of complex AC voltage waveforms
- (b) The instrument provide a meter indication by sensing the input wave arm heating power
- (c) Thermocouple used in the meter will produce the output proportional to E_{rms}^2
- (d) None of the above

7. Ac voltmeters are usually

- (a) RMS responding type
- (b) Average Responding type
- (c) Read more for all non sinusoidal waveforms
- (d) None of the above

8. Chopper stabilized amplifier

- (a) Is used for amplifying AC current
- (b) Is used for amplifying DC current and relatively low frequency AC currents
- (c) It first converts AC in to DC signal then high gain amplification
- (d) None of the above

9. Electronic multi meter has

- (a) A balanced bridge DC amplifier
- (b) Input attenuator or a range switch
- (c) Rectifier section to convert an Ac input voltage to a DC value
- (d) All the above

10. False statement in connection with the attenuators

- (a) Attenuation in dB = $20 \log (V_o/V_i)$
- (b) Design of attenuator is depends upon level of attenuation, characteristics impedance and the frequency of operation
- (c) Cascading a number of attenuators is for increase the overall attenuation
- (d) Π section attenuator network are used to achieve higher attenuation level

11. During the retrace time the electron forming the horizontal beam

- (a) Move from left to right on the screen
- (b) Move from right to left on the screen
- (c) Move from top to bottom on the screen
- (d) None of the above

12. Identify the false statement

- (a) Sampling oscilloscope is used to examine very low signals
- (b) Samples are taken at different portion of the uniform waveform over successive cycles
- (c) Horizontal deflection of electron beam is obtained by the application of a staircase waveform to X plates
- (d) None of the above

13. Which is the false statement in connection with delay lines
- (a) Are used to observe leading edge of the signal waveform
 - (b) Are used to delay the signal applied at the horizontal plates
 - (c) It will appear almost anywhere along the vertical signal path and to trigger pickoff must precede the delay line
 - (d) None of the above
14. The impedance of the basic bridges are $Z_1 = 100 \Omega$ at an angle 80° and $Z_2 = 250 \Omega$, $Z_3 = 400 \Omega$ at an angle 30° . Find the unknown Z_4 which is opposite to Z_1 in the bridge circuit
- (a) 160Ω at an angle 50°
 - (b) 100Ω at an angle -50°
 - (c) 1000Ω at an angle -50°
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15. Which is the false statement
- (a) Kelvin bridge is used for the measurement of low resistance
 - (b) Maxwell bridge is used for the measurement of inductance
 - (c) Schering bridge is used for the measurement of inductance
 - (d) None of the above
16. Which is the false statement in connection with CRO?
- (a) The grid potential determine the intensity of the electron beam
 - (b) In alternate mode of Dual trace oscilloscope the electronic switch alternate between A and B letting each through for one cycle of the horizontal sweep
 - (c) In chopped mode of dual trace oscilloscope the electronic switch alternate between A and B letting each through for one cycle of the horizontal sweep
 - (d) None of the above
17. A lissajous pattern on an oscilloscope is stationary and has 5 horizontal tangencies and 2 vertical tangencies. The frequency of the horizontal input is 1000 Hz. The frequency of vertical input is
- (a) 400 Hz
 - (b) 2500 Hz
 - (c) 1500 Hz
 - (d) None of the above
18. Determine the resistor value required to use 1 - mA meter with an internal resistance of 125Ω for a 0 - 1 v meter
- (a) 855Ω
 - (b) 125Ω
 - (c) 250Ω
 - (d) None of the above

19. What will be the value of potential divider attenuator resistor if the attenuation is 20 dB and the load resistance is $50\ \Omega$.

- (a) $150\ \Omega$
- (b) $450\ \Omega$
- (c) $350\ \Omega$
- (d) None of the above

20. The resolution of 4 1/2- digit voltmeter and the display of 15.95 on 10 V range with the same meter are

- (a) 0.01 % , 15.950
- (b) 0.01 % , 1.595
- (c) 0.001 % , 1.595
- (d) 0.01 % , 15.95

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