

FIFTH SEMESTER EXAMINATION – 2005

ELECTRONICS MEASUREMENT AND
MEASURING INSTRUMENTS

Full Marks – 70

Time : 3 Hours

*The figures in the right hand margin indicate
full marks for the questions.*

IWL Answer Q. No. 1 which is compulsory and any five
questions from the remaining.

1. Answer the following questions : 2×10
- (a) A power of – 5 dBm is dissipated in a 100-ohm resistor. What is the voltage across the load ?
- (b) Which one of the two – a voltmeter with a sensitivity of 10,000 Ω/v or a voltmeter with a sensitivity of 30,000 Ω/v – will have

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smaller loading effect in measuring a voltage across a circuit and why ?

- (c) For bridge balance is it sufficient that products of the magnitudes of opposite arms must be equal ? If not why not ?
- (d) Why should the measuring instruments have high input impedance ?
- (e) RF probe enables a DC voltmeter to make high frequency ac measurement. What is the typical RF probe circuit and how does it enable as stated above ?
- (f) Lissagous figures of two sinusoidal signals of same frequency are observed on an oscilloscope. The figures are (i) a 45° -straight line, (ii) a circle and (iii) an ellipse. Comment on the amplitude and phase relationships between the two signals for each case.
- (g) Why squarewave testing of an amplifier is done ?

(h) What is meant by dynamic range of a spectrum analyzer ? Which factors limit the smallest signal measurable ?

- (i) Show the spectrum analyzer measurement display of a square wave.
- (j) Give a schematic arrangement of measuring time delay between two pulses using an oscilloscope.

2. A balanced ac bridge has the following conditions :
arm AB, $R = 2000 \Omega$ in parallel with $C = 0.047 \mu\text{F}$;
arm BC, $R = 1000 \Omega$ in series with $C = 0.47 \mu\text{F}$;
arm CD is unknown ; arm DA, $C = 0.5 \mu\text{F}$. The frequency of oscillator is 1 kHz. Find the constants of arm CD. 10

3. (a) List broad specification of a state of the art Digital Voltmeter as regards its input range, absolute accuracy, short term and long term stability, resolution, input characteristics, and output signal. 5

(b) In a ramp type digital voltmeter explain with the help of neat voltage to time conversion diagram how an input voltage is measured.

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4. A function generator is to generate sine, square and triangular wave forms. Draw a functional diagram and explain how these waveforms are generated.

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5. How is an RF signal generator different from a function generator? Give the conceptual block diagram of a signal generator consisting of an audio oscillator, VCO, modulator, amplifier and variable attenuator and explain how AM and FM signals can be generated by it. Explain the role of VCO in the generation of the desired signal.

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6. Draw the block diagram of a frequency counter which has to count 0 to 99,999. Draw the timing diagram of the counter. Explain how does it work.

Describe how noise on a signal can create an erroneous frequency count?

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7. (a) Implement a spectrum analyzer using a bank of filters. What is the major disadvantage of this spectrum analyzer.

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(b) What are the measurements which can be made using a spectrum analyzer. How the dynamic range of a spectrum analyzer determined?

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8. (a) What are the salient features of a Wire Strain Gauge and Semiconductor Strain Gauge?

A strain gauge has a resistance of 120Ω and a gauge factor of 2.1. What will be change in the resistance produced if the gauge is subject to a strain of 0.0005?

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(b) A 10-bit DAC is connected to a 2560V dc reference. Find the output voltage if the

digital word at the input is 1011111111_2 (i.e., 767_{10}). $2\frac{1}{2}$

(c) An electronic instrument is used to measure voltage of a 2-kHz (i) sine wave and (ii) square wave. What bandwidth will be required in the two cases ? Assume that any harmonic greater than 10% of fundamental is to be included. $2\frac{1}{2}$

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