Total number of printed pages – 7 **B. Tech**

CPEN 5303

Sixth Semester Examination – 2008

ELECTRONICS INSTRUMENTATION AND MEASUREMENT

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10

   (a) Draw the voltage-to-current converter circuit using op-amp.

   (b) A 20 V d.c. voltage is measured by analog multimeters. Multimeter is on its 25 V range and its specified accuracy is ± 2%. Determine the measurement accuracy.

   (c) A digital frequency meter has a time base derived from a 1 MHz clock generator frequency-divided by decade counters. Determine the measured frequency when a 1.512 kHz sine wave is applied and the time base uses four decade counters.

   (d) How the brightness of display in a CRO is controlled ?

   (e) What do you mean by 'deflection factor' and 'deflection sensitivity' of a CRO ?

   (f) Draw the circuit for displaying diode forward characteristics in a CRO.

   (g) Draw the Lissajous pattern with two equal voltage of equal frequency and (i) 0° phase (ii) 60° phase (iii) 90° phase (iv) 120° phase.

(h) Draw the Lissajous pattern with frequency ratio (i) 2 : 1 (ii) 3 : 2.

(i) What is sweep frequency generator ? Draw the block diagram.

(j) Sketch the spectrum analyzer display that are likely to be produced by the following inputs :

(i) An amplitude-modulated sine wave-form.

(ii) A sine wave with a small amount of harmonic distortion.

2. (a) Sketch the complete circuit of an Op-Amp voltage follower voltmeter. Explain the circuit operation and compare it to the simple emitter-follower voltmeter. 6

(b) A simple emitter-follower voltmeter circuit has V_{cc} = 12 V, R_m = 1 kΩ, a 2 mA meter and a transistor with h_{FE} = 80. Calculate a suitable resistance for R_s to give full scale deflection when E = 5 V. Also , determine the voltmeter input resistance. 4

3. (a) Draw the basic block diagram of a digital frequency meter, sketch the system wave-forms and explain its operation. 6

(b) Calculate the maximum time t_1 for a ramp type digital voltmeter if the clock generator frequency is 1.5 MHz. Also, suggest a suitable frequency for the ramp generator. 4

4. (a) Sketch the basic construction of a CRT (Cathod Ray Tube). Identify each section

of the tube and explain the operation of the CRT. 5

(b) Explain the operation of a single beam dual trace system. Also explain the use of this system in chop mode and in alternate mode. 5

5. (a) Sketch the basic circuit and output wave-form of an oscilloscope sweep generator and explain the circuit operation. 6

(b) The ramp output from sweep generator circuit is to have its time period doubled. How should C_1 be modified ? If the time period is to be adjusted by $\pm$ 10%, what modification should be made ? 4

6. (a) Sketch the basic block diagram for a sine/ square wave generator. Explain briefly. 6

(b) A wein bridge oscillator circuit has $C_1 = C_2 = 250$ nF and $R_1 = R_2 =$ (variable from 200 Ω to 3 kΩ). Calculate the maximum and minimum output frequencies and determine the new capacitor values required to give $f_{max} = 300$ Hz. 4

7. (a) Sketch circuits to show how a.c. voltmeters and ammeters should be calibrated using standard instruments. Explain. 5

(b) A basic potentiometer has 200 cm slide wire with a resistance of 100 Ω. A 4 V battery in series with a variable resistance R_1 provides current through the slide wire. The standard cell potential is 1.018 V and the potentiometer is calibrated when the sliding contact is set to 101.8 cm from the zero voltage end of the slide wire.

(i) Calculate R_1 and the current through R_1. 2.5

(ii) Determine the measured voltage when zero galvanometer deflection is obtained with the slide wire at 94.3 cm from the zero voltage end. 2.5

8. (a) Sketch the block diagram for a spectrum analyzer and explain the system operation. 5

(b) Sketch the circuit and waveforms for an Op-Amp astable multivibrator for use as a square wave generator and explain its operation. 5

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