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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

P.T.O.

and its specified accuracy is $\pm 2\%$. 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 waveform.

(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 $V_{CC} = 12\text{ V}$, $R_m = 1\text{ k}\Omega$, a 2 mA meter and a transistor with $h_{FE} = 80$. Calculate a suitable resistance for R_s to give full scale deflection when $E = 5\text{ V}$. Also, determine the voltmeter input resistance. 4
3. (a) Draw the basic block diagram of a digital frequency meter, sketch the system waveforms 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 waveform 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 $C_1 = C_2 = 250 \text{ nF}$ and $R_1 = R_2 =$ (variable from 200Ω to $3 \text{ k}\Omega$). Calculate the maximum and minimum output frequencies and determine the new capacitor values required to give $f_{\text{max}} = 300 \text{ Hz}$. 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 100Ω . A 4V 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