(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0323 Roll No. | | | | | | | | | | |

B.Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2011-12

ELECTRONIC INSTRUMENTATION AND MEASUREMENTS

Time : 3 Hours] *[Total Marks : 100*

Note : Answer **all** the Sections.

Section – A

1. Attempt **all** parts. **10 × 2 = 20**

(a) Determine the dimensions of force, work, energy and power.

(b) Calculate the maximum percentage error in the difference of two measured voltages when $V_1 = 100\ V \pm 1\%$ and $V_2 = 80\ V \pm 5\%$.

(c) Define Swamping Resistance. From what it is made of ?

(d) How Emitter-Follower structure reduces Voltmeter loading ?

(e) Determine the final output frequency from the frequency-divider, if the three decade counters are replaced by scale-of-16 counters.

(f) Define burden voltage. What it represents ?

(g) How to measure lower limit resistance measurement in Wheatstone bridge ?

(h) Why, a pure capacitance has a high dielectric resistance and virtually zero power dissipation ?

(i) List the precautions to be taken to measure small L, C and R quantities.

(j) How to calibrate DC ammeter ?

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Section – B

2. Attempt any **three** parts. **3 × 10 = 30**

(a) The ohmmeter circuit has E_b = 1.5 V, R_1 = 15 KΩ, R_m = 50 Ω, R_2 = 150 Ω and meter FSD = 125 μA. Determine the ohmmeter scale reading at 0.5 FSD, and determine the new resistance value that R_2 must be adjusted to when E_b falls to 1.1 V. Also re-calculate the value of R_x at 0.5 FSD when E_b = 1.3 V.

(b) A Digital Storage Oscilloscope (DSO) has a sampling rate of 100 MS/s. Determine the number of samples taken during one cycle of a 3 MHz sine wave, and during a 15 μs pulse. Also, estimate the maximum time period of a glitch that might be missed by the sampling process.

(c) Explain the quantization error that occurs with an ADC; show how it affects the accuracy of the output. A ramp ADC with a 2 MHz clock generator is to have 1000 clock pulses representing a 1 V input. Specify the required ramp voltage.

(d) Define reciprocal counting. Draw the basic block diagram of the digital frequency meter rearranged for reciprocal counting. Explain its operation, and show why reciprocal counting is sometimes used in preference to the straight counting method.

(e) A 500 Hz triangular wave with peak amplitude of 40 V is applied to the vertical deflecting plates of a CRT. A 250 Hz saw-tooth wave with peak amplitude of 50 V is applied to the horizontal deflecting plates. The CRT has a vertical deflection sensitivity of 0.1 cm/V and a horizontal deflection sensitivity of 0.08 cm/V. Assuming that the two inputs are synchronized, determine the waveform displayed on the screen.

Section – C

Attempt **all** parts. **5 × 10 = 50**

3. Attempt any **two** parts.

(a) Sketch the half-wave rectifier a.c electronic voltmeter using a voltage follower. Explain the operation of circuit, and compare its performance.

(b) Sketch the circuit of a compensated wattmeter, and explain how it eliminates measurement errors.

(c) Draw the circuit diagram of an Op-amp non-inverting amplifier voltmeter. Explain its operation, and compare it to the voltage-follower voltmeter.

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4. Attempt any **two** parts.

(a) Draw a block diagram to show how decade counters may be used for frequency division. Show the system wave forms and explain its operation.

(b) A frequency meter measuring the ratio of two frequencies displays 1133 when the pulses of the unknown frequency (f_2) are counted over 1000 cycles of the known frequency (f_1). If f_1 is 33 kHz, determine f_2.

(c) Explain the substitution method of resistance measurement. Draw an appropriate diagram.

5. Attempt any **two** parts.

(a) Determine the accuracy of measurement of a Wheatstone bridge that uses precision resistors with an accuracy of $\pm$ 0.025% and an adjustable precision resistor that has an accuracy of $\pm$ 0.05%.

(b) Draw the circuit diagram of a diode/capacitor voltage multiplying circuit. Explain how this circuit produces a high d.c voltage from a battery.

(c) Derive equations for converting a series RC circuit into its equivalent parallel circuit.

6. Attempt any **two** parts.

(a) Sketch the circuit diagram of a Maxwell bridge. Derive the equations for the resistive and inductive components of the measured inductor.

(b) Sketch the basic circuit and output wave forms of an oscilloscope sweep generator. Explain the circuit operation.

(c) Sketch the basic block diagram of a delayed-time-base (DTB) system. Explain the system operation.

7. Attempt any **two** parts.

(a) Draw the basic circuit of a staircase waveform generator and explain its operation.

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

(c) Compare the performance of light-beam and pen-type galvanometric strip-chart recorders.

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