ELECTRONIC INSTRUMENTATION AND MEASUREMENT
(AEIE 3202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The capture range of a PLL depends on
(a) phase detector (b) cut off frequency of LPF
(c) amplifier gain (d) none of these.

(ii) In a CRO the brightness control is adjusted by adjusting the potential applied to the
(a) cathode (b) first focussing anode
(c) horizontal deflection amplifier (d) grid.

(iii) For a digital voltmeter having 4-1/2 digit display, the input voltage of 0.8654V on 10V range will be displayed as
(a) 0.865 V (b) 0.86 V
(c) 0.8654 V (d) 0.8 V.

(iv) An OPAmp based non inverting amplifier has biasing voltages +12V & -12V and gain 10. For the input of 2 volt the output voltage will be
(a) +20 V (b) + V_{sat} (c) +8 V (d) - V_{sat}.

(v) The commercially available chip for VCO is
(a) NE505 (b) NE566
(c) NE565 (d) NE506.

(vi) The output frequency of VCO having external capacitance 500pF, external resistance 10Kohm, dc control voltage 10V and supply voltage $V^+ = 12$ V is
(a) 50 KHz (b) 20 KHz
(c) 66 KHz (d) 80 KHz.

(vii) Deflection factor of a CRO is expressed in
(a) Ω/V (b) cm/V (c) V/cm (d) V/Ω.

(viii) If the phase difference between two same frequency signals applied to both vertical & horizontal plates is 180°, then the Lissajous figure will be
(a) a straight line (b) a circle
(c) an ellipse (d) a hyperbola.

(ix) Post deflection acceleration system is provided in CRT to
(a) focus the electron beam (b) reduce noise
(c) increase brightness of display (d) reduce heat.

(x) Charge amplifier is used in
(a) VCO (b) Hall effect transducer
(c) piezoelectric transducer (d) ramp type DVM.

Group – B

2. (a) Draw the circuit for a FET input voltmeter using dual emitter follower and an input attenuator. Hence show how the input voltage is measured by it.

(b) What are the disadvantages of dc voltmeter while used for measurement of low voltage? How is it overcome by using chopper stabilized dc voltmeter?

(3 + 4) + (2 + 3) = 12

3. (a) What is the advantage of thermocouple type true r.m.s. voltmeter over other ac electronic voltmeter? With the circuit diagram of it show how it is advantageous.

(b) Design a current mirror circuit and explain its operation. What is its use in electronic circuits?

(2 + 5) + (4 + 1) = 12

Group – C

4. (a) Using a Schmitt trigger and a ramp generator design a time base circuit for CRO. Explain the operation of it. What is the significance of the term TIMES/DIV regarding time-base of CRO?

(b) Explain the operation of 10:1 attenuation probe used for CRO.

(3 + 4 + 2) + 3 = 12

5. (a) Draw the block diagram of sampling, storage and display unit of a digital storage oscilloscope. How is an input waveform sampled, stored and then recovered to display in a digital storage oscilloscope?

(b) A 1V signal (V_s) with a source resistance of R_s = 600Ω is connected to an oscilloscope which has an input impedance of R_i = 1 MΩ in parallel with C_i = 30pF. The coaxial cable has a capacitance of C_{cc} = 100pF. Calculate the oscilloscope terminal voltage (V_i) when the signal frequency is 100Hz. Also determine the frequency at which V_i is 3dB below V_s.

(3 + 6) + 3 = 12

Group – D

6. (a) How is a time-base generation circuit giving a 100Hz clock signal made by using 1 MHz crystal oscillator and decade counters?

(b) How is the unknown frequency of an ac signal measured by using a digital frequency meter? Calculate the percentage error in measuring the input signal frequency of 100MHz by digital frequency meter.

3 + (7 + 2) = 12

7. (a) Explain the operation of dual-slope integrating type DVM.

(b) For an input voltage an 8-bit ADC having reference voltage 5volt gives digital output 11010010. Find the input voltage. What will be the display voltage if this input voltage is displayed in a 4 & ½ digit display unit for 100 volt range?

7 + 5 = 12

Group – E

8. (a) How parallel connection method of Q meter is used to find impure capacitance and inductance and their Q values.

(b) What are the possible errors in measurement of Q value of unknown coil? What are the remedies to minimize these errors?

7 + (2 + 3) = 12

9. (a) Explain the operation of a swept superheterodyne spectrum analyzer. What is resolution bandwidth of spectrum analyzer?

(b) What are the different modules of virtual instrumentation? Explain these by showing the architecture of it.

(5 + 1) + 6 = 12