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) If K_ϕ is the phase to voltage transfer coefficient & A is the amplifier gain, then for the upper and lower frequency range with respect to free running frequency of PLL , the maximum control voltages will be
(a) $\pm\pi K_\phi A$ (b) $\pm(\pi/2) K_\phi A$
(c) $\pm 2\pi K_\phi A$ (d) $\pm(\pi/3) K_\phi A$

(ii) Considering V_{ref} = -10 volt, if the integrating capacitor is 0.1μF, resistor is 1MΩ in a voltage to frequency converter circuit, then the output frequency for 5 volt is
(a) 1Hz (b) 10Hz
(c) 6Hz (d) 5Hz

(iii) A true r.m.s thermocouple ammeter is used to measure a 10MHz sine wave and it indicates a current of 2 Amperes. The peak current in this waveform is
(a) 2 Amperes (b) 2.83 Amperes
(c) 0.2 Amperes (d) 20 Amperes

(iv) A sine wave having time period 4ms and V_{pp} = ±2volt is applied to the vertical deflecting plates of a CRT. If the vertical deflection sensitivity is 2 cm/volt, then at 1.5 ms the vertical deflection of the electron beam in cm will be
(a) 4.8 cm (b) 4 cm
(c) 2 cm (d) 2.8 cm

(v) A circuit which can be used to convert a sine waveform into a pulse waveform is
(a) non-inverting amplifier (b) inverting amplifier
(c) Schmitt Trigger (d) summing amplifier

(vi) In dual trace oscilloscope for measuring the low frequency signal the best selected mode is
(a) alternate mode (b) chop mode
(c) x-y mode (d) sweep mode

(vii) How many decade counters are required to get 100Hz clock signal from 1MHz crystal oscillator?
(a) 6 (b) 4
(c) 5 (d) 8

(viii) The input impedance of the oscilloscope at the front panel is typically
(a) 1MΩ in parallel with 30pF (b) 1MΩ in parallel with 100pF
(c) 1MΩ in series with 30pF (d) 10MΩ in parallel with 100pF

(ix) A spectrum analyser is used across the frequency spectrum of a given signal to study the
(a) current distribution (b) voltage distribution
(c) energy distribution (d) power distribution

(x) For the measurement of self capacitance of a coil, at 3 MHz supply frequency, the tuning capacitor is set to 350 pF and at 6 MHz frequency the capacitor is tuned to 70 pF to achieve resonance. The self capacitance of the coil is
(a) 40.3 pF (b) 23.3 pF
(c) 60.3 pF (d) 10.3 pF

Group – B

2. (a) With neat diagram, explain the operation of electronic multimeter.

(b) With neat diagram, explain the operation of practical emitter follower voltmeter.

(c) A practical emitter follower voltmeter circuit has 3.9 kΩ resistances connected to emitter terminals of two BJTs and has Vcc = ±12V. Determine
(i) Current through two 3.9 kΩ resistances
(ii) Meter circuit voltage when input voltage is 1V.

5 + 5 + 2 = 12

3. (a) Explain the operation of a rectifier type voltage to current converter with neat diagram. What is the speciality of precision rectifier type electronic voltmeter in ac voltage measurement?

(b) The half wave rectifier type voltage to current converter circuit uses a 1mA FSD meter with 1.2kΩ coil resistance. Calculate the resistance connected between the inverting and common terminal to give full scale defection for a 100 mV (rms) ac input. Also, determine the meter deflection for a 50 mV ac input.

(5 + 2) + (3 + 2) = 12

Group – C

4. (a) Which type of signal is applied to the horizontal deflection amplifier prior to horizontal deflecting plate system of a CRO? Design and explain the circuit to generate this type of signal.

(b) How can the phase difference between two input sine wave signals having same frequencies be measured by using CRO? How is it possible to measure the phase difference for the signals having different frequencies?

(1 + 2 + 3) + (4 + 2) = 12

5. (a) What is the purpose of delayed time base oscilloscope? Draw the block diagram of it and show the waveforms at each stages of it.

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

(1 + 2 + 5) + 4 = 12

Group – D

6. (a) Design a digital frequency meter circuit for the measurement of frequency in MHz range and explain the operation of it.

(b) What are the errors in measuring frequency by digital frequency meter? Find out the percentage error in measuring frequency of the signals having frequencies 1MHz and 100Hz.

7 + (2 + 3) = 12

7. (a) Show how an input analog dc voltage of 3.9 volt is measured by using 3-bit successive approximation type digital voltmeter?

(b) In a dual slope ADC, the reference voltage is 100mV and the first integration period is set as 50ms. The resistance and capacitance of the integrator are 100kΩ and 0.047μF. What will be the second integration period for an input voltage of 140mv.

7 + 5 = 12

Group – E

8. (a) With neat diagram, explain the parallel connection method of Q meter to find impure capacitance and inductance and their Q values.

(b) What is self capacitance of a coil? A coil with a resistance of 10Ω is connected in the direct measurement mode of Q meter. Resonance occurs when the oscillator frequency is 1MHz and the resonating capacitor is set at 65pF. Calculate the % error introduced in measurement of Q value by 0.02Ω insertion resistance.

5 + (2 + 5) = 12

9. (a) With neat diagram, explain the operation of series ohmmeter. What are the advantages of shunt ohmmeter over it?

(b) What is signal to noise ratio? What are the different types of noises?

(7 + 2) + (1 + 2) = 12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/MzY0Nzc1MzEyOTM1/a/MzY0Nzc3MTQwMzQz/details