CHAPTER-10
POTENTIOMETRIC RECORDERS AND Q - METER

10. Ans: (c)

Sol: $V_{in} = 500mV, \quad V_{out} = 10V$

$$\text{Circuit Q} = \frac{\text{voltage across capacitor (or) output voltage}}{\text{input voltage (or) supply voltage}}$$

$$Q = \frac{10}{50\times10^{-3}} = 20$$

12. Ans: (a)

Sol: Inductor tunes to $f_1 = 2mHz \quad C_1 = 450pF$

$f_2 = 4mHz \quad C_2 = 90pF$

$$n = \frac{f_2}{f_1} \Rightarrow n = 2$$

$$\text{Distributed capacitor } C_d = \frac{C_1 - n^2C_2}{n^2 - 1}$$

$$= \frac{450\times10^{-12} - (2)^2 90\times10^{-12}}{(2)^2 - 1} = 30pF$$

Previous IES Questions (EEE)

05. Ans: (d)

Sol: Self capacitance (or) distributed capacitor (C_d)

Frequency	capacitor
f_1	$C_1 = 300pF$
f_2	$C_2 = 60pF$

$$f_2 = 2f_1 \quad \Rightarrow n = \frac{f_2}{f_1} = 2$$

$$C_d = \frac{C_1 - n^2C_2}{n^2 - 1} = \frac{300\times10^{-12} - (2)^2\times10^{-12}}{(2^2 - 1)}$$

$$C_d = 20pF$$

CHAPTER-11
OSCILLOSCOPES

One Mark Questions

02. Ans: (b)

Sol: CRO screen has ten divisions on horizontal scale

N_H = 10 Time base setting = 5 m sec/div $\frac{\text{Time}}{\text{div}}$

$f_{signal} = 50\text{Hz} \Rightarrow T_{signal} = \frac{1}{50} = 0.02$

$T_{sweep} = N_H \times \frac{\text{Time}}{\text{div}}$

$T_{sweep} = 10 \times 5 \times 10^{-3} = 50$ msec

$n \rightarrow$ no. of cycles of signal displayed

$$n = \frac{T_{sweep}}{T_{signal}} = \frac{50\times10^{-3}}{0.02} = 2.5 \text{ cycles}$$

Two marks questions

06. Ans: (c)

Sol: Given that

Samples per second = 10^7

Cycles per second = 100×10^3 Hz

$$\text{Samples per cycle} = \frac{\text{samples per second}}{\text{cycles per second}}$$

$$= \frac{10^7}{100\times10^3} = 10^2$$

Previous IES questions

06. Ans: (c)

Sol: With 12Vat M & range switch at (q):

$$VFS_{(q)} = 12V \times \frac{2M\Omega}{10M\Omega} = \frac{12}{5}V$$

Now, with 'XV' at M & range switch at (s), same FSV is obtained

$$\text{i.e., } \frac{12}{5}V = X \times \frac{200k\Omega}{10M\Omega}$$

$$\Rightarrow X = \frac{10M\Omega}{200k\Omega} \times \frac{12}{5}V = 120V$$

07. Ans:(a)

Sol: Frequency ratio is 2

$\therefore$ 2 cycles of sine wave displayed on vertical time base

09. Ans: (d)

Sol: $V_x = 10\cos(100t + \theta)$

$V_y = 10\sin(100t + \theta)$

$= 10\cos(100t+\theta+90)$

A circle can be formed in lissajious pattern only

When the magnitude of the two signals are equal and the phase difference between them is either 90^0 (or) 270^0

10. Ans: (c)

Sol: $V_x = 5\cos(\omega t + \theta)$

$V_y = 5\sin(\omega t + \theta)$

$= 5\cos(\omega t+\theta + 90^0)$

The magnitude of two signals are equal and having phase difference 90^0. The resulting Lissojious pattern will be circle.

18. Ans: (b)

Sol: A circle can be formed only when the magnitude of two signals are equal and the phase difference between them is either 90^0 (or) 270^0

23. Ans: (d)

Sol: Minimum sampling frequency ≥ highest frequency= 2kHz

Number of bits is given by

$$0.01 = \frac{1}{2^n - 1} \times 100 \quad \Rightarrow n = 1426.$$

26. Ans: (a)

Sol: Time period = $\frac{1}{200}$ = 5 ms

Range of x = 0.5×10 = 5mV

Amplitude (max) = $300\sqrt{2}$

Range of Y = 8 × 100 = 800mV

One cycle of undistorted sine wave can be viewed

32. Ans: (b)

Sol: $T = 6 \times 30 = 180\mu s = 180 \times 10^{-6}$ s

$f = \frac{1}{T} = \frac{10^6}{180} = 5.5kHz$

CHAPTER-12
ELECTRONIC MULTIMETER & DIGITAL VOLTMETER

One Mark questions

01. Ans: (c)

Sol: Sensitivity $S_{DC} = 1000\Omega$ /volt

It measures half full scale = $\frac{V_{FSD}}{2}$

$V_{FSD} = 100V$

$R_V = S_{DC} \times V_{FSD}$

$R_V = 1000 \times 100$

$R_V = 100k\Omega$

$I_{mFSD} = \frac{\frac{V_{FSD}}{2}}{R_V} = \frac{100/2}{100\times10^3} = 0.5mA$

$I_{mFSD} = 0.5mA$

03. Ans: (b)

Sol: Time taken for the first integration (N_F) = $10\times\frac{1}{50} = 0.2$ sec

Reference voltage $V_r = 2V$

Input voltage $V_m = 1V$

From $\frac{V_m}{V_V} = \frac{nt}{N_F}$

$n_t = \left(\frac{V_m}{V_r}\right)N_F$

$= \frac{1}{2}\times 0.2$

$n_t = 0.1$ sec

Total conversion time = $N_F + n_t$

$= 0.2 + 0.1 = 0.3$ sec

04. Ans: (b)

Sol: The resolution of a 3½ digit voltmeter is

Resolution = $\frac{1}{10^N}$

Where N = 3

Resolution = $\frac{1}{10^3} = \left(\frac{1}{1000}\right)$

Two mark questions

08. Ans: (a)

Sol: Given that

$V_r = 100mV$

First integration time $t_1 = 300 \times 10^{-3}$ sec

De – integration period $t_2 = 370.2 \times 10^{-3}$ sec

We have $V_m = V_r \frac{t_2}{t_1}$

DVM indicate = $V_m = 100 \times \frac{370.2 \times 10^{-3}}{300 \times 10^{-3}}$

$V_m = 123.4mV$

Previous IES Questions

01. Ans: (a)

Sol: Resolution = $\frac{1}{\text{extended scale}} \times \text{voltage range}$

Resolution = 100mV

N = 3

Extended scale $= 10^N$

$= 10^3$

Voltage range $= 10^3 \times 100 \times 10^{-3}$ V

$= 100V$

02. Ans: (c)

Sol: Full scale voltage = 300V

Accuracy = ± 2% of 300V

$= \pm \frac{2}{100} \times 300 = \pm 6$

True value = 222

The actual voltage lies b/w = 222 ± 6

$\Rightarrow 222 + 6 = 228V$

$\Rightarrow 222 - 6 = 216V$

09. Ans: (b)

Sol: To eliminate the effect of 100Hz noise present in the input signal, Time period of integration (1^{st}) must be equal to period (or integral multiples of period of that sine component)

T_1 = 1 period of 100Hz

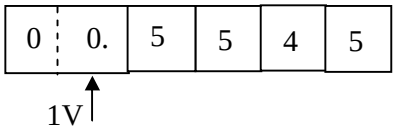
$500 \times \frac{1}{fclk} = 1 \times \frac{1}{100Hz}$

$f_{clk} = 500 \times 100Hz$

$f_{clk} = 50$ kHz

11. Ans: (a)

Sol: Given that
1V range 4½ DVM,
Reading 0.5245
$V_m = 0.5245$



Reading on 1V range is no change

13. Ans: (c)

Sol: $S_{AC(F.W)} \rightarrow$ A.C sensitivity of full wave rectifier
$S_{DC} \rightarrow$ D.C sensitivity
$S_{AC(F.W)} = 0.9\ S_{DC}$

22. Ans: (c)

Sol: Samples per sec = 10^8
Cycles per sec = 10kHz
Number of samples taken per cycle of input

$$\text{Samples per cycle} = \frac{\text{samples per second}}{\text{cycles per second}}$$

$$= \frac{10^8}{10 \times 10^3} = 10^4$$

25. Ans: (b)

Sol: A 12 bit A/D converter has a range 0 – 10V

$$\text{Resolution of converter} = \frac{1}{2^{n-1}} \text{ voltage range}$$

Where n = 12

$$\text{Resolution} = \frac{1}{2^{12}-1} \times 10$$

$$= 2.44\text{mV}$$

28. Ans: (a)

Sol: DVM has range 3½

0 0 0 0
Min voltage- 0 0 0 1
. . . .
0 9 9 9
1 0 0 0
Max voltage- 1 9 9 9

CHAPTER-13
INSTRUMENT TRANSFORMER

Two Mark Questions

10. Ans: (a)

Sol: Given that

$f = 50Hz, \quad N_2 = 500$

$I_S = 5A, \quad R = 1\Omega$

Magnatizing turns = 200AT

Bar primary = 1turn

$I_0 = 200 \times 1$

$I_0 = 200A$

About α, δ nothing is mentioned neglect

$$\text{Phase angle error } \theta = \frac{I_0 \cos(\alpha + \delta)}{nI_s} \quad \text{red}$$

$$\theta = \frac{I_0}{nI_s} \times \frac{180}{\pi} \text{ degrees}$$

$$\theta = \frac{200 \times 180}{500 \times \pi \times 5} = 4.6 \text{ degrees}$$

11. Ans:

Sol: The flux in the CT core is

$$\text{emf } E_2 = 4.44 \times f \times \phi_m \times N_2$$

$$\phi_m = \frac{E_2}{4.44 \times f \times N_2} = \frac{5 \times 1}{4.44 \times 50 \times 500} = 45\mu Wb$$