Total No. of printed pages = 5

19/6th Sem/UIE 602

2022

ELECTRONIC INSTRUMENTATION

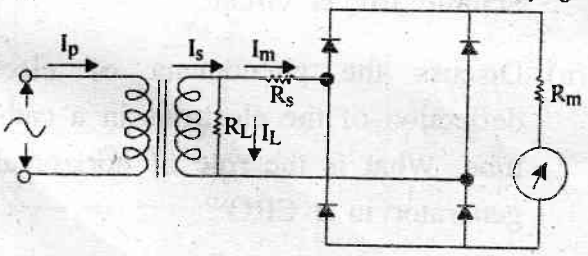
Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Explain how does a PMMC type DC ammeter work? A rectifier ammeter as shown below gives Full Scale Deflection (FSD) for a primary current of 250 mA. The PMMC meter has FSD = 1mA and $R_m = 1700\Omega$. The current transformer has $N_S = 500$ and $N_P = 4$. If each of the diodes have $V_F = 0.7V$ and series resistance $R_S = 20\ k\Omega$, calculate the required value of R_L. 4+6=10



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(b) Explain the working of induction type wattmeter and derive the relationship between torque and power. 10

2. (a) How a RF signal can be converted to a signal of intermediate frequency ? Describe how a true RMS value of a signal can be obtained by using thermocouple ? Explain the working of an LCR meter. 2+3+5=10

(b) What are the Barkhausen criteria for the generation of oscillating signal ? Explain the working of phase locked loop for synthesizing desired frequency. 2+8=10

3. (a) What happens to the capacitance of a varactor diode, when the applied reverse biased voltage is increased ? Describe how a voltage controlled oscillator works ? 2+4=6

(b) Explain how square wave signals can be generated ? Illustrate the operation of a Schmitt trigger circuit. 7+7=14

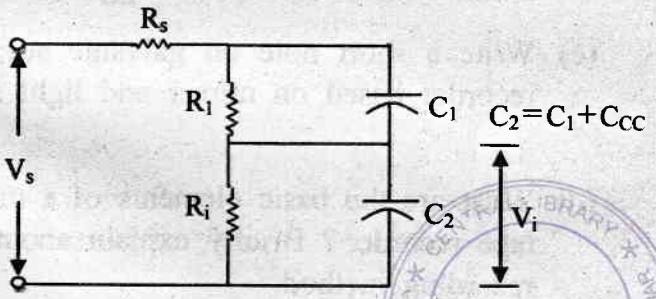
4. (a) Discuss the phenomena of electrostatic deflection of the electrons in a cathode ray tube. What is the role of horizontal sweep generator in a CRO ?

A 500 Hz triangular wave with a peak amplitude of 40V is applied to the vertical deflecting plates of a CRT. A 250 Hz sawtooth wave with a peak amplitude of 50V 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.

2+2+8=12

(b) Draw the circuit of 10 :1 oscilloscope probe by distinguishing signal source, probe and oscilloscope part of the circuit.

Calculate the value of C_1 required to a 10 :1 probe when the oscilloscope input capacitance is 30 pF and the coaxial cable capacitance is 100 pF. Also calculate the probe input capacitance seen from outside. 3+5=8



5. (a) What is quantization error of an ADC ? Explain the working of successive approximation type ADC. 2+5=7

(b) What are the advantages of digital multimeter over analog multimeter ? A 20V DC voltage is measured by analog and digital multimeters. The range of the analog instrument is 25 V and its specified accuracy is ± 2.5%. The digital meter has 3½ digit display and accuracy of ±(0.6+1). Determine the measurement accuracy of the two meters. 2+3=5

(c) With the help of a block diagram describe the working principle of digital frequency meter. 8

6. (a) How is bar graph display different from dot matrix display ? —Explain. 3

(b) What is a data logger ? What are the different standard protocols for connecting instrumentation systems to a data logger ? 2+1=3

(c) Write a short note on galvanic strip chart recorder based on mirror and light source. 6

(d) What are the basic elements of a magnetic tape recorder ? Briefly explain about direct recording method. 3+5=8

7. Write short notes on any *four* of the following : 5×4=20

(i) Vector voltmeter

(ii) Sweep frequency generator

(iii) Heterodyne harmonic analyzer

(iv) Digital storage oscilloscope

(v) Digital frequency meter

(vi) X-Y recorder.