b) Describe the principle of operation of a frequency synthesizer with neat block diagram. Compare direct and indirect frequency synthesis methods. 3+4

*****

B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(6th Semester)

Course No: ECC-605

(Electronic and Instrumentation and Measurement)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. a) Draw the circuit diagram of Wheatstone Bridge for resistance measurements. Obtain an expression for unknown resistance, write the advantages and disadvantages. 2+3+3

b) In the Wheatstone bridge, the values of resistances of various arms are P= 1000 Ω, Q= 100 Ω, R= 2,005 Ω and S= 200 Ω. The battery has an emf of 5 V and negligible internal resistance. The galvanometer bas a current sensitivity of 10 mm/μA and an internal resistance of 100 Ω. Calculate the deflection of the galvanometer and the sensitivity of the bridge in terms of deflection per unit change in resistance. 6

2. a) Find the equivalent parallel resistance and capacitance that causes a Wien bridge to null with the following component values. $R1=2.7K\ \Omega$, $C1=5\mu F$, $R2=22K\ \Omega$, $R4=100K\ \Omega$ at the operating frequency is 2.2KHz. 6

b) Draw the circuit diagram of Maxwell Bridge for inductance measurements. Obtain an expression for unknown inductance, quality factor and power factor. 2+3+3

UNIT-II

3. a) Explain an AC voltmeter using full wave rectifier. Explain with neat circuit diagrams. What are the advantages and limitations of this design compared to other AC measurement techniques? 7

b) True RMS voltmeters are crucial for accurate measurements in non-sinusoidal AC circuits. Could you explain how a true RMS voltmeter operates with circuit diagram and why it is necessary for certain types of AC loads? 7

4. Explain the fundamental differences between analog and digital ammeters, voltmeters, and ohmmeters with neat circuit diagrams and derive the relations of current, and how do these variances impact their applications in DC and AC circuits? 4+4+4+2

UNIT-III

5. Compare and contrast the operation and characteristics of resistance, capacitance, and inductance transducers. Define strain gauge with different types? How do strain gauges function as transducers, and what techniques are employed to enhance their sensitivity and accuracy in measuring mechanical strain? 6+2+6

6. a) Discuss the principle of operation and applications of piezoelectric transducers with neat construction diagram, emphasizing their ability to convert mechanical stress into electrical signals. 7

b) Describe the construction and working principle of an LVDT (Linear Variable Differential Transformer) transducer, highlighting its advantages and limitations. 7)

UNIT-IV

7. Explain digital frequency counter with neat block diagram and explain each block in details. How frequency is measured using the digital frequency counter. 4+5+5

8. Explain the working operation of an X-Y recorder with neat diagram. List advantages and applications of X-Y recorder. 5+4+5

UNIT-V

9. Explain the RF signal generators with block diagram. What are the primary applications of RF signal generators in electronic testing and measurement? Discuss the importance of frequency range, output power, and modulation capabilities. 5+4+5

10. a) Explain the working mechanism of a sweep frequency generator with neat block diagram. How is it used to test the frequency response of electronic components and systems? 4+3