

B. TECH.
(SEM III) THEORY EXAMINATION 2022-23
ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

- (a) Differentiate primary and secondary type of measuring Instruments.
- (b) Write principle of operation for thermocouple type instruments.
- (c) Write advantages and disadvantages of Anderson's bridge for the measurement of inductance?
- (d) How Hay's Bridge is suitable for the measurement inductance of large Q coils.
- (e) Define turns ratio and transformation ratio for CT and PT.
- (f) Write applications of Instrument Transformers.
- (g) Write the application of sweep generator in CRO
- (h) Draw the Lissajous pattern for the frequency ratio 3:2.
- (i) Differentiate primary and secondary Transducers with the help of examples.
- (j) Define active and passive transducer with the help of example.

SECTION B

2. Attempt any *three* of the following: 10x3=30

- (a) The resistance value for three registers are specified as $R_1 = 100 \Omega \pm 5\%$, $R_2 = 200 \Omega \pm 5\%$ and $R_3 = 300 \Omega \pm 5\%$. Determine the value of limiting error in ohms and in percentage for the total equivalent resistance, if they are connected in (i) Series and (ii) parallel, respectively.
- (b) Draw the working circuit of Hay's bridge for measurement of inductance. Derive the equations for balance and also draw its phasor diagram. State its merits and demerits.
- (c) Draw the equivalent circuit and phasor diagram of current transformer. State the ratio error present in current transformer.
- (d) Classify different types of electronic voltmeters. Explain DC voltmeters with the help of suitable diagrams.
- (e) Describe the principle of operation, construction, working and applications of Hall effect transducers.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

- (a) Write the principle of operation, working of PMMC instruments with necessary diagram. Illustrate the expression of torque equations.
- (b) Describe the construction and working principle of electro dynamometric type instrument with suitable diagram.

4. Attempt any *one* part of the following: 10x1=10

- (a) Derive balance equation of Schering Bridge with its phasor diagram and dissipation factor. Mention advantages and disadvantages of this bridge.
- (b) Derive balance equation of Maxwell's Inductance Bridge with its phasor diagram. Also find the quality factor for this bridge. Mention advantages and disadvantages of this bridge.

5. Attempt any *one* part of the following: 10x1=10

- (a) A current transformer with a bar primary has 300 turns in its secondary winding. The resistance and reactance of secondary circuit are 1.5 and 1.0 ohm respectively. The current flowing in the secondary winding is 5 A, the magnetizing m.m.f is 100 AT and iron loss is 1.2 W. Determine the ratio and phase angle error.
- (b) Draw the equivalent circuit and phasor diagram of potential transformer, also derive the expression of phase angle of potential transformer.

6. Attempt any *one* part of the following: 10x1=10

- (a) Describe the construction and working of general purpose CRO with its block diagram and explain its components.
- (b) Describe the working principle of spectrum analyzer with the help of suitable block diagram. List the various applications of spectrum analyzer.

7. Attempt any *one* part of the following: 10x1=10

- (a) Describe the construction and working of strain gauge transducer.
A resistance strain gauge having a gauge factor of 2, it is subjected to a strain of 10^6 , if the resistance of the unstrained gauge is 120Ω . Calculate the change in resistance of the gauge.
- (b) Describe the principle of operation, construction of piezoelectric transducers.
A piezoelectric crystal has a thickness of 2.5 mm and voltage sensitivity 0.05 Vm/N . Determine the output voltage when it is subjected to a pressure of $1.6 \times 10^6 \text{ N/m}^2$.