KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

13 AUG 2024

Level : B.E.
Year : III
Time : 2 hrs. 30mins.

Course : EPEG 317
Semester : I
F. M. : 40

SECTION "B"
[5 Q. × 8 = 40 marks]

Attempt ANY FIVE questions. Assume any suitable data if required.

1.

a. A set of 10 independent measurements were made to determine the diameter of a bob of a simple pendulum. The measured values in *cm* were 2.570, 2.597, 2.591, 2.562, 2.577, 2.580, 2.564, 2.586, 2.550, and 2.575. Determine the arithmetic mean, average deviation, standard deviation and variance. [4]

b. Discuss briefly on the purpose of control system and types of control. [4]

2.

a. With the help of suitable diagram explain the construction and working of linear variable differential transformer (LVDT). [4]

b. A parallel plate capacitive transducer uses plates of area $450mm^2$ which are separated by a distance $0.3mm$ and having air as dielectric. Calculate

i. The change in capacitance if the transducer is subjected to a linear displacement which reduces the distance between the plated to $0.27mm$.
ii. The ratio of per unit change of capacitance to per unit change of displacement.
iii. If a mica sheet of thickness $0.02mm$ is inserted in the gap, determine the value of actual capacitance, the change in capacitance for the same displacement and the ratio per unit change in capacitance to per unit change in displacement. Assume dielectric constant of mica to be 8. [$\varepsilon_0 = 8.854 \times 10^{-12}$] [4]

3.

a. Design a differentiator to differentiate an input signal that varies in frequency from $20Hz$ to $1kHz$. [5]

b. Given that the V_{ref}= 10V, R_F=R=1kΩ and resistance tolerance is 2%. Find the V_{max} and V_{min} for 5-bit input with binary weighted DAC. Also, find resolution & FSV. [3]

4.

a. What are different types of data acquisition systems? [3]

b. Define Asynchronous mode of transmission? Explain TTL to RS-232 conversion. [2+3]

5.

a. With essential circuit diagram explain the working principle of CT. [3]

b. With the help of circuit diagram explain Maxwell inductance capacitance bridge and evaluate unknown parameters. Also draw the phasor diagram. [5]

P.T.O.

6.

a. A kelvin double bridge circuit shown in **Figure 1** has each of the ratio arms $P=Q=p=q=$ 1000Ω. The emf of the battery is $100V$ and the resistance of 5Ω is included in the battery circuit. The galvanometer has the resistance of 500Ω and the resistance of the link connecting unknown resistance to the standard resistance may be neglected. The bridge is balanced when the standard resistance is $S=0.001\Omega$. (a) Determine the value of unknown resistance, (b) determine the current (approximate value) through the unknown resistance R at balance. (c) Determine the deflection of the galvanometer when the unknown resistance 'R' is changed by 0.1% from its value at balance. The galvanometer has sensitivity of 200mm/μA. [6]

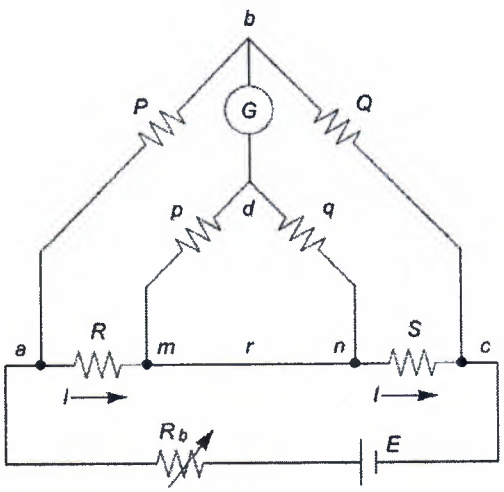

Figure 1

b. The secondary of CT should not be left open, instead it should be shorted or must be connected with a low resistance coil such as current coils of wattmeter, coil of ammeter etc. Why? Discuss the circumstances and consequences briefly. [2]

7.

a. With essential circuit diagram explain the working principle of CT. [3]

b. With the help of circuit diagram explain Maxwell inductance capacitance bridge and evaluate unknown parameters. Also draw the phasor diagram. [5]

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Marks Scored:

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Time: 30 mins.

F. M. : 10

Registration No.:

Date : 13 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. Which of the following instruments indicate the instantaneous value of the electrical quantity being measured at the time at which it is being measured?
   a. Absolute Instruments
   b. Indicating Instruments
   c. Recording Instruments
   d. Integrating Instruments

2. Resistances can be measured with the help of
   a. wattmeter
   b. voltmeter
   c. ammeter
   d. ohmmeter and resistance bridges

3. A moving-coil permanent-magnet instrument can be used as _____ by using a low resistance shunt.
   a. ammeter
   b. voltmeter
   c. fluxmeter
   d. ballistic galvanometer

4. Induction type single phase energy meters measure electric energy in
   a. kW
   b. VAR
   c. kVAR
   d. kWh

5. _____ is an instrument which measures the insulation resistance of an electric circuit relative to earth and one another.
   a. Tangent Galvanometer
   b. Megger
   c. Current Transformer
   d. Tachometer

6. Analog signal conditioning circuit is not used for ……
   a. Filtration
   b. Amplification
   c. level shifting
   d. sampling

7. An experiment was conducted for two instruments. Probability density graph of two instruments is given in **Figure 1.** From the graph it is clear that instrument 2 is _____ compared to instrument 1.
   a. accurate
   b. precise
   c. both accurate and precise
   d. neither precise nor accurate

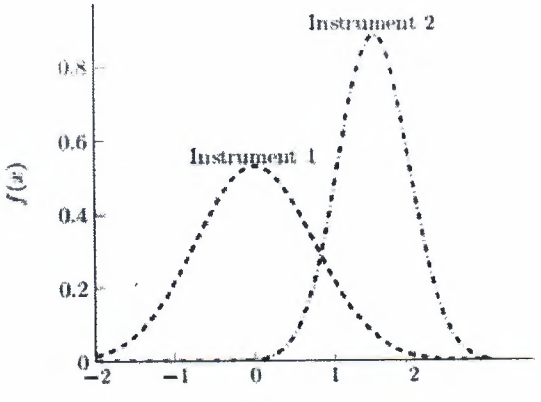

Figure 1

8. In a 3-phase power measurement by two wattmeter method, both the wattmeters have identical readings. The power factor of the load is
a. unity b. 0.8 lagging c. 0.8 leading d. zero

9. For measurement of inductance having high value, we should use
a. Maxwell's bridge b. Maxwell Wein bridge
c. Hay's bridge d. Harald's bridge

10. Under which of the following conditions a bridge is balanced?
a. When no current flows b. when the temperature of the circuit is high
c. when power dissipation is high d. when no voltage drops across the circuit

11. The minimum number of wattmeter(s) required to measure 3-phase, 3-wire balanced power is
a. 1 b. 2 c. 3 d. 4

12. Resistance of a galvanometer is 0.5Ω and the full scale deflection corresponds to 10mA. What is the shunt resistor required to increase the range of instrument to 1A?
a. $\frac{70}{99}\Omega$ b. $\frac{40}{99}\Omega$ c. $\frac{6}{990}\Omega$ d. $\frac{5}{990}\Omega$

13. LVDT cannot measure
a. Weight b. Pressure c. Acceleration d. Temperature

14. Which of the following has negative temperature coefficient?
a. Strain Gauge b. Thermistor
c. Thermocouple d. RTD

15. In a 4-bit weighted-resistor DAC, the resistor value corresponding to LSB is 32kΩ. Then the resistance corresponding to MSB will be
a. 4kΩ b. 8kΩ c. 16kΩ d. 32kΩ

16. A PMMC can be converted to wattmeter by replacing permanent magnet with _____
a. filament b. movable coil c. fixed coil d. Semiconductor

17. Output voltage of following circuit in Figure 2 is _____

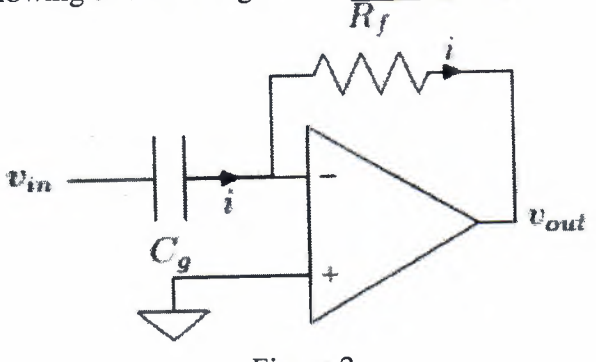

Figure 2

a. $\frac{R_f}{C_g}\frac{dv_{in}}{dt}$ b. $R_f C_g \frac{dv_{in}}{dt}$ c. $\frac{C_g}{R_f}\frac{dv_{in}}{dt}$ d. $\frac{1}{R_f C_g}\frac{dv_{in}}{dt}$

18. A 5 bits ADC has the reference voltage of 2V. The number of decision levels in the ADC is _____
a. 30 b. 31 c. 32 d. 33

19. An ohmmeter is a
a. moving iron instrument b. moving coil instrument
c. moving steel instrument d. dynamometer instrument

20. In an energy-meter braking torque is produced to
a. Safeguard it against creep
b. brake the instrument
c. bring it to stand still
d. maintain steady speed and equal to driving torque