

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Mark scored:

Level : B.E.

Year : III

Exam Roll No.:

Time: 30 mins.

Course : EPEG 317

Semester: I

F.M. : 20

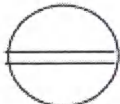
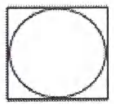
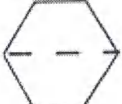

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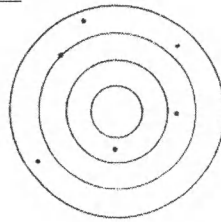
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SECTION "A"
[20 Q.×1=20]

Choose the best answer.

- Cruise control in an automobile is an example of _____.
[a] open loop control [b] close loop control
[c] programmable logic control [d] automatic gain control
- If a process temperature needs to be kept within 5 °C of 100 °C, then the set-point is _____.
[a] 5 °C [b] 100 °C [c] 95 °C [d] 105 °C
- In a temperature control loop, if 110 °C is the measured variable and 100 °C is the set-point then the error is _____.
[a] 10 °C [b] -10 °C [c] 10 [d] -10
- What does the acronym P&ID stand for?
[a] Piping and Instrument Designing
[b] Piping and Instrumentation Drawing
[c] Process Control and Installation Drawing
[d] Proportional, Intergral and Derivative control
- Which of the following is a symbol of a pneumatic valve?
[a]  [b]  [c]  [d] 
- An electrical space heater draws 15 A from a 120 V source. It is operated, on average, for 5 hours each day. At a rate of \$0.12 per kWh, how much does it cost to operate the heater for 30 days?
[a] \$ 32400 [b] \$ 32.4
[c] \$ 32.4 per hour [d] \$ 32400 per hour
- A set of measurement is given as
409, 406, 402, 407, 405, 404, 407, 404, 407, 407, 408.
The median value is _____.
[a] 402 [b] 404 [c] 405 [d] 407

8. System shown is _____.



- [a] accurate and precise [b] not accurate and not precise
[c] not accurate but precise [d] accurate but not precise

9. A pressure of 2 bars produces a deflection of 10 degrees in a pressure transducer; the sensitivity of the instrument is _____.

- [a] 5 degrees/bar [b] 0.2 bar/degrees
[c] 0.2 degrees/bar [d] 5 bar/degrees

10. Any instrument with

$$a_1 \frac{dq_0}{dt} + a_0 q_0 = b_0 q_i$$

behaviour is _____ instrument.

- [a] null [b] zero order [c] first order [d] constant

11. Measurement sets that only contain random errors usually conform to a _____ distribution.

- [a] chi-square [b] Gaussian [c] rectangular [d] binomial

12. Burden of a current transformer is the _____.

- [a] primary load [b] secondary load
[c] primary voltage [d] secondary voltage

13. A moving coil meter is a commonly used form of _____.

- [a] a multimeter [b] an analog ohm-meter
[c] an analog voltmeter [d] a digital ohm-meter

14. Precision rectifiers are used to _____.

- [a] filter signal [b] rectify signal
[c] amplify and rectify signal [d] attenuate and rectify signal

15. Comparator is _____ bit/bits ADC.

- [a] 0 [b] 1 [c] 2 [d] 3

16. The DAQ device with a +/-10 V range and 12 bits of resolution can detect a _____ mV change.

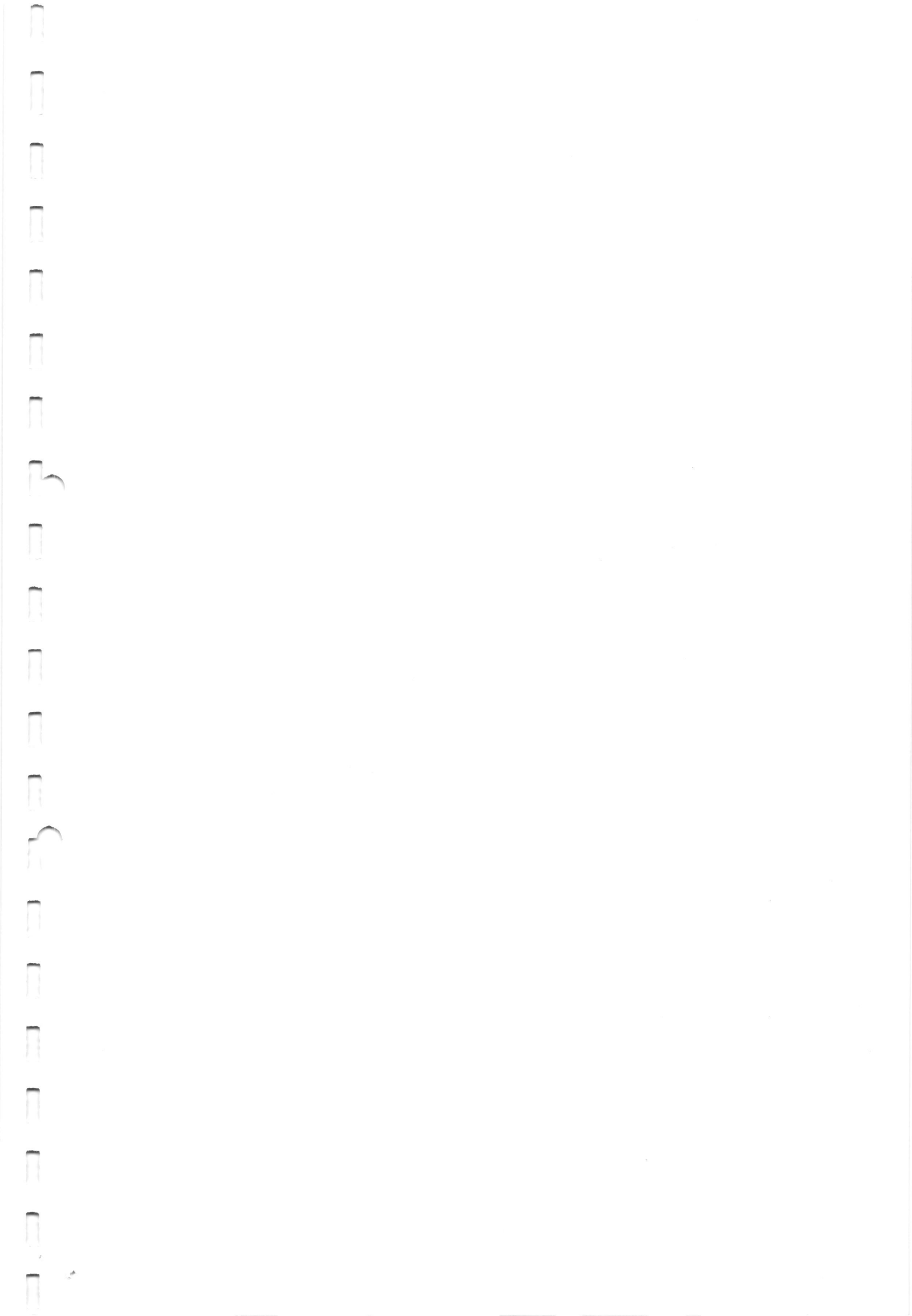
- [a] 2.5 [b] 5 [c] 410 [d] 205

17. Basic equation to design circuit for DAC is _____.

- [a] $A = kD$ [b] $D = kA$ [c] $A = D^k$ [d] $D = A^k$

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18. The basic principle behind _____ is based on the electrical dipole.
[a] thermistor [b] gyro sensor [c] piezoelectricity [d] strain gauge
19. _____ has fast response.
[a] Thermistor [b] RTD [c] Thermocouple [d] IC Sensor
20. A Hall-effect sensor is a transducer that varies its output _____ in response to a
_____.
[a] current, voltage [b] voltage, current
[c] voltage, magnetic field [d] current, magnetic field



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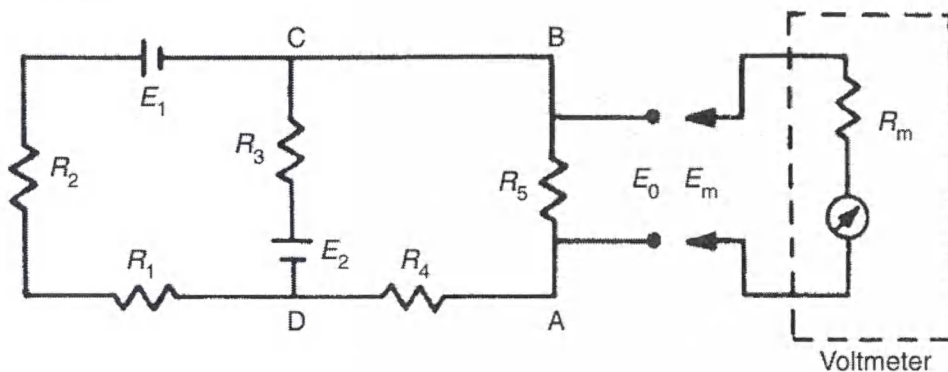
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Year : III
Time : 2 hrs. 30 mins.

Course : EPEG 317
Semester: I
F.M. : 55

SECTION "B"
[5 Q.×11=55 marks]

*Attempt any FIVE questions.
Symbols have their usual meaning.
Assume suitable data if necessary.*

- 1.a. Suppose that the components of the circuit shown in the figure have the following values: $R_1 = 400\Omega$; $R_2 = 600\Omega$; $R_3 = 1000\Omega$; $R_4 = 500\Omega$; $R_5 = 1000\Omega$. The voltage across AB is measured by a voltmeter whose internal resistance is 9000Ω . What is the measurement error in percentage caused by the resistance of the measuring instrument? [5]



- b. A spring balance is calibrated in an environment at a temperature of 20°C and has the following deflection/load characteristic.

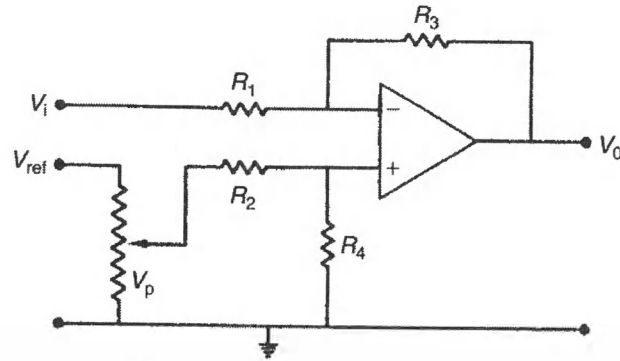
Load (kg)	0	1	2	3
Deflection (mm)	0	20	40	60

It is then used in an environment at a temperature of 30°C and the following deflection/load characteristic is measured.

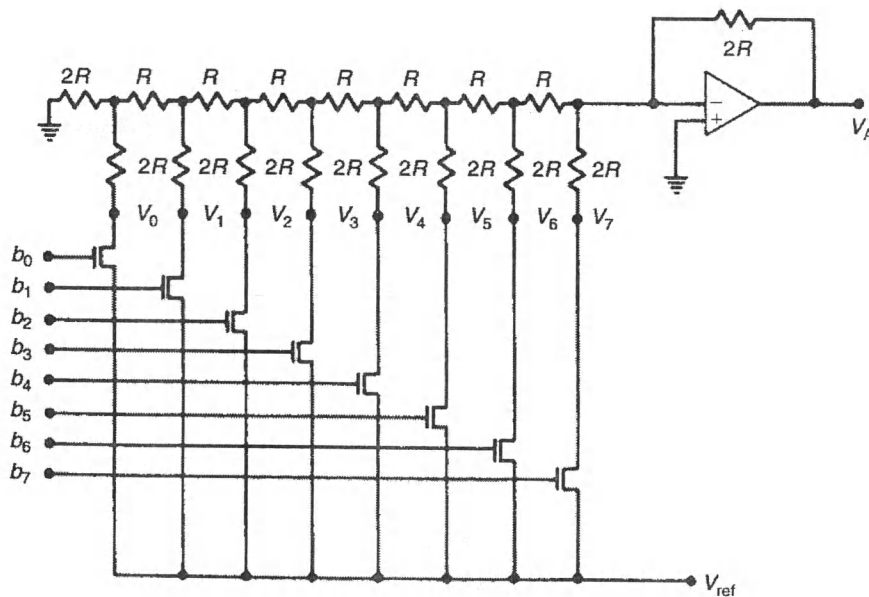
Load (kg):	0	1	2	3
Deflection (mm)	5	27	49	71

Sketch the transfer characteristics and determine the zero drift and sensitivity drift per $^\circ\text{C}$ change in ambient temperature. [6]

- 2.a. With necessary derivations and output voltage expression, show that the circuit can be used to remove zero drift. [5]



- b. With necessary figures, define precision and accuracy of a measuring instrument. [6]
- 3.a. With figure, explain the construction and basic working mechanism of moving coil meter. [5]
- b. Design a circuit of operational amplifier based instrumentation amplifier and find the voltage gain of such amplifier. [6]
- 4.a. Electrocardiogram (ECG) is a system used to monitor the electrical activity of the heart over a period of time using electrodes placed on the skin. Develop with explanation a suitable block diagram for analog front end electronics for such system. [5]
- b. Design a circuit with explanation to monitor liquid level using pressure sensor. The circuit should take the necessary action according to the level of liquid. [6]
- 5.a. Explain quantization error in Analog to Digital Converter with figure. Draw ideal transfer characteristics for 3 bit Analog to Digital Converter (ADC). [5]
- b. Derive the expression for output voltage in the circuit shown. [6]



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- 6.a. Draw the circuit of Wheatstone bridge and derive an expression for balance condition of the same circuit. [5]
- b. Write short notes on: [6]
- [i] Piezoelectric effect, piezoelectric sensors and applications.
 - [ii] Hall effect, Hall effect sensors and applications.

