



# UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/DEC 2018

COURSE NO : RN 275  
COURSE NAME: ELECTRONICS AND INSTRUMENTATION  
CLASS : RN II TIME: 3 HOURS

## ANSWER ALL QUESTIONS

### SECTION A

ANSWER *TRUE OR FALSE* from 1 to 70 and *A, B, C or D* from 71 to 90 in your answer booklet. *Half mark will be deducted for every wrong answer given from 1 to 70.* You will be instructed as to how to arrange the numbering of your answers in your answer booklets. The question paper in **Section A** must be tied loosely *into* the answer booklet and therefore not leaving the Exams Room.

(45 marks)

### *INSTRUMENT AND MEASUREMENTS QUESTIONS*

1. The controlling torque becomes equal and opposite to the deflecting torque at final deflection position.
2. An Intelligent Measuring System is a digital measuring system.
3. The environment where a measure is taken can affect the results of the measurement.
4. A multirange ammeter can be constructed simply by employing several values of parallel resistances, with a rotary switch to select the desired range.
5. At final deflected position, the controlling torque becomes equal and opposite to the damping torque.
6. Ammeter sensitivity is greater when the amount of current required in producing a full-scale deflection of the pointer is high.
7. A bridge circuit employs the null method and operates on the principle of comparison.
8. The Wheatstone bridge is suitable for resistance values between 10 k $\Omega$  to 10 M $\Omega$ .
9. The source voltage of an ac bridge is an ac voltage at a desired frequency.
10. The Wien Bridge can be used to measure the unknown frequency of an AC voltage source.
11. The Induction Wattmeter is used for dc power only.
12. The dynamometer wattmeter can be made to give a very high degree of accuracy.
13. The dynamometer wattmeter can be used on dc supply.
14. The induction type wattmeter can be used to measure ac power only.
15. The induction type of wattmeter has high power consumption.
16. The signal converter is made up of the signal processor, signal conditioner and the signal transmitter.
17. Errors can result from the insertion of the instrument into a particular location to measure a quantity.
18. The deflecting and controlling devices move in opposition to ensure zero oscillation of the pointer.
19. The damping force influence slightly the steady state deflection produced by a given deflecting force or torque.
20. An instrument which measures the input power of an engine is called a dynamometer.
21. Precision of a measuring instrument is a measure of the scatter of results obtained from measurements as a result of specific errors.
22. Dynamic accuracy occurs when the measuring quantities change slowly.
23. Noise signals at their point of origin are generally very small.

24. The noise present in a received radio signal is termed external noise.
25. Man-made-noise is lowest in sparsely populated areas.
26. The force exerted by controlling devices must act in opposition to the sense of the deflecting force.
27. The damping force brings the moving system to rest at the deflected position reasonably quickly without any oscillation or negligible oscillation.
28. The principle of operation of an electromagnetic measuring instrument utilizes the magnetic effects of electric currents.
29. The sensing element improves the quality of the signal.
30. At rest, the controlling force helps bring the position of the pointer reasonably quickly at full-scale output without any oscillation or negligible oscillation.

### ***LINEAR ELECTRONICS***

31. Passive filters are built with frequencies below 1 MHz.
32. Active filters are built with resistors, capacitors and inductors.
33. Filters can block interfering signals and enhance speech.
34. An ideal low-pass filter has infinite phase shift for all frequencies in the passband.
35. An ideal high-pass filter has infinite attenuation in the stopband and zero attenuation in the passband.
36. The basis of waveform generation is the use of an oscillator.
37. An instrument which measures the input power of an engine is called a dynamometer.
38. The term operational amplifier (op amp) refers to an amplifier that performs scientific operations.
39. Most op amps are currently made in monolithic integrated circuit forms.
40. Modulation is the process of putting information onto a low-frequency carrier for transmission.
41. Noise present in a received signal introduced in the transmitting medium is termed internal noise.
42. Extremely sensitive communications equipment is located at sparsely populated areas.
43. Information theory is the study of information to provide for the most efficient use of a channel for electrical communications.
44. Information that can be transmitted in communications systems is inversely proportional to the product of the bandwidth utilised times the time of transmission.
45. Almost all communication systems use filters.

### ***DIGITAL ELECTRONICS***

46. Digital systems are not easy to programme by a set of digital instructions.
47. The transfer function is a graph of digital output to analogue input.
48. Analogue systems transmit without regard to signal content.
49. A truth table should be included as part of the specification of any combinational logic circuit.
50. Electronic circuits are physical systems that lend themselves well to the representation of binary numbers.
51. A logical equation is said to be minimised when it contains high possible number of literals.
52. A NAND gate is referred to as universal gate.
53. One common application of logic gate is to control the flow of electrical logic signals along some path.
54. A typical application of logic gates is in the control of motors.
55. Logic gates usually come in the form of integrated circuits.
56. The NOR gate is more commonly called an inverter.

57. Sequential circuits have the property of input-to-output immediacy and can store large amount of data.
58. Sequential logic circuits have the tendency to store and retrieve data.
59. Creating a device that can latch onto data at a desired moment in time is a subject devoted to combinational logic circuits.
60. A switching device or circuit works by changing between two stable states.
61. Digital systems are exceedingly small in size and require large power to operate.
62. Circuits known as the sample and hold amplifiers are often employed in conjunction with analogue to digital converters to store analogue information during conversion.
63. Digital systems are extremely cheap and operate quickly.
64. In discrete-state systems, only a finite, usually fixed, number of different states are allowed.
65. Digital systems have absolute precision since multiple signals can be used.
66. Digital circuits can also be termed as switching circuits.
67. Continuously varying signals are digital signals.
68. The process of quantisation and encoding is known as the analogue to digital converter.
69. Resolution in the digital to analogue converter is the smallest change in the input digital word that will result in a change in the output analogue voltage.
70. The greater the number of input bits, the lesser is the number of steps required to reach full-scale output.

**CHOOSE WHICH DOES NOT BELONG BY INDICATING YOUR ANSWER AS A, B, C or D**

- |     |                          |                                      |
|-----|--------------------------|--------------------------------------|
| 71. | A. Summing Amplifier     | B. Operational Amplifier             |
|     | C. Voltage Follower      | D. Summing Amplifier (Non-Inverting) |
| 72. | A. Amplitude modulation  | B. Phase modulation                  |
|     | C. Wave modulation       | D. Frequency modulation              |
| 73. | A. Man-Made-Noise        | B. Internal Noise                    |
|     | C. Atmospheric Noise     | D. Space Noise                       |
| 74. | A. Operational Amplifier | B. Resistors                         |
|     | C. Capacitors            | D. Inductors                         |
| 75. | A. Operational Amplifier | B. Resistors                         |
|     | C. Capacitors            | D. Transistors                       |
| 76. | A. Quantise              | B. Decode                            |
|     | C. Hold                  | D. Sample                            |
| 77. | A. Digital Computers     | B. Audio Amplifier                   |
|     | C. Mobile phones         | D. Digital Clock                     |
| 78. | A. Boolean equation      | B. Boolean algebra                   |
|     | C. Karnaugh map          | D. Tabulation techniques             |
| 79. | A. Function              | B. Decoding                          |
|     | C. Encoding              | D. Comparison                        |
| 80. | A. S-C flip-flop         | B. J-K flip-flop                     |
|     | C. Flip Flop             | D. D flip-flop                       |
| 81. | A. Controlling device    | B. Calibration device                |
|     | C. Damping device        | D. Deflecting device                 |

82. A. Balance weight  
C. Gravity control
83. A. Air friction  
C. Damping force
84. A. Sensing element  
C. Display element
85. A. Operating Errors  
C. Instrument Error
86. A. Instrument noise  
C. Atmospheric noise
87. A. Construction Errors  
C. Approximation Errors
88. A. Panel instrument  
C. Integrating instrument
89. A. Control spring  
C. Spindle
90. A. Graduated Scale  
C. Balance weight
- B. Control weight  
D. Spindle
- B. Fluid friction  
D. Eddy current
- B. Signal converter  
D. Signal transmitter
- B. Observational Errors  
D. Human Errors
- B. Man-made-noise  
D. Space noise
- B. Calibration Errors  
D. Ageing Errors
- B. Indicating instrument  
D. Recording instrument
- B. Control weight  
D. Balance weight
- B. Control weight  
D. Control spring

## SECTION B

Answer all questions in this section

### QUESTION 1

- a) i) What is the null method of operation as employed in bridge circuits? (2 marks)  
ii) Draw the circuit diagram of a Wheatstone bridge. (2 marks)
- b) i) Give two advantages and disadvantages of multi-range voltmeter. (2 marks)  
ii) How are measuring instruments broadly classified? (2 marks)  
iii) Explain briefly the three basic parts of measuring instruments? (6 marks)
- c) Briefly explain the following common sources of errors in measuring instruments:  
1) Observational Errors (2 marks)  
2) Approximation Errors (2 marks)  
3) Insertion Errors (2 marks)

**(Total marks = 20)**

### QUESTION 2

- a) i) What is the null method of operation as employed in bridge circuits? (2 marks)  
ii) Draw the circuit diagram of a Wheatstone bridge. (2 marks)
- b) i) Give two advantages and disadvantages of multi-range voltmeter. (2 marks)  
ii) How are measuring instruments broadly classified? (2 marks)  
iii) Explain briefly the three basic parts of measuring instruments? (6 marks)
- c) Briefly explain the following common sources of errors in measuring instruments:  
1) Observational Errors (2 marks)  
2) Approximation Errors (2 marks)  
3) Insertion Errors (2 marks)

**(Total marks = 20)**

### QUESTION 3

- a) Which of the following involve analogue quantities or digital quantities or both? Explain your answers:  
i) The operation of the bi-metallic strip;  
ii) Edible oil being poured from a one litre bottle into a frying pan;  
iii) Gas flowing through a pipe;  
iv) A bag of powdered milk; and  
v) Automobile speedometer. (5 marks)
- b) Reduce this expression using Karnaugh maps only:  
$$ABC + A\overline{B}C + \overline{A}BC$$
 (2.5 marks)
- c) Reduce this expression using Boolean algebra only:  
$$\overline{A}BC + A\overline{B}C + \overline{A}BC$$
 (2.5 marks)
- d) Using block diagrams, distinguish between a digital to analogue and analogue to digital converters. (5 marks)

**(Total marks = 15)**

**Dr C. K. Amuzuvi/Mr J. Annan**

## Boolean Identities and Theorems

SN.	Boolean addition	Boolean multiplication	Property
1	$A+B = B+A$	$A.B = B.A$	Commutative
2	$A+(B.C) = (A+B)(A+C)$	$A(B+C) = (AB) + (AC)$	Distributive
3	$A+(B+C) = (A+B)+C$ $= A+B+C$	$A(BC) = (AB)C$ $= ABC$	Associative
4	$A + A = A$	$AA = A$	Idempotence
5	$A + \bar{A} = 1$	$A\bar{A} = 0$	Complement
6	$I+A = I$	$0A = 0$	
7	$0+A = A$	$IA = A$	Identity
8	$A = \bar{\bar{A}}$		Involution
9	$A+AB = A$	$A(A+B) = A$	Absorption
10	$A + \bar{A}B = A + B$ $\overline{\overline{A+B}} = A + B$	$B(A + \bar{B}) = AB$ $\overline{\overline{AB}} = AB$	Simplification
11	$\overline{A+B+C+D} = \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot \bar{D}$		De Morgan's Law
12	$\overline{\bar{A} \cdot \bar{B} \cdot \bar{C} \cdot \bar{D}} = A + B + C + D$		