

Question Booklet No. :

CEEI/2024

Register
Number

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2024

Paper – I

ELECTRONICS AND INSTRUMENTATION ENGINEERING
(Degree Standard)

Duration : Three Hours]

[Total Marks : 300

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. You will be supplied with this question booklet 15 minutes prior to the commencement of the examination.
2. This question booklet contains 200 questions. Before answering the questions, you shall check whether all the questions are printed serially and ensure that there are no blank pages in the question booklet. **If any defect is noticed in the question booklet, it shall be reported to the invigilator within the first 10 minutes and get it replaced with a complete question booklet. If the defect is reported after the commencement of the examination, it will not be replaced.**
3. Answer all the questions. All the questions carry equal marks.
4. You must write your register number in the space provided on the top right side of this page. Do not write anything else on the question booklet.
5. An answer sheet will be supplied to you separately by the room invigilator to shade the answers. Instructions regarding filling of answers etc., which are to be followed mandatorily, are provided in the answer sheet and in the memorandum of admission (Hall Ticket).
6. You shall write and shade your question booklet number in the space provided on page one of the answer sheet with **BLACK INK BALL POINT PEN**. If you do not shade correctly or fail to shade the question booklet number, your answer sheet will be invalidated.
7. Each question comprises of five responses (answers) : i.e. (A), (B), (C), (D) and (E). You have to select **ONLY ONE** correct answer from (A) or (B) or (C) or (D) and shade the same in your answer sheet. If you feel that there are more than one correct answer, shade the one which you consider the best. **If you do not know the answer, you have to mandatorily shade (E).** In any case, choose **ONLY ONE** answer for each question. If you shade more than one answer for a question, it will be treated as a wrong answer even if one of the given answers happens to be correct.
8. You should not remove or tear off any sheet from this question booklet. You are not allowed to take this question booklet and the answer sheet out of the examination room during the time of the examination. After the examination, you must hand over your answer sheet to the invigilator. You are allowed to take the question booklet with you only after the examination is over.
9. **You should not make any marking in the question booklet except in the sheets before the last page of the question booklet, which can be used for rough work. This should be strictly adhered to.**
10. Failure to comply with any of the above instructions will render you liable for such action as the Commission may decide at their discretion.

SEAL

[Turn over

SPACE FOR ROUGH WORK



1. Choose the correct frequency generation by the following oscillator

1. Audio Frequency Oscillator (AFO) – upto 3 GHz
2. Radio Frequency Oscillator (RFO) – 20 KHz to 30 MHz
3. Very High Frequency Oscillator (VHF) – 3 MHz to 20 MHz
4. Ultra High Frequency Oscillator (UHF) – 300 MHz to 3 GHz

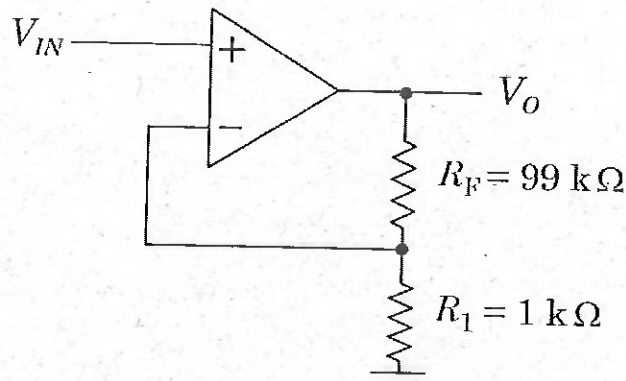
- (A) 1 and 3 correct (B) 2 and 3 correct
~~(C)~~ 2 and 4 correct (D) 3 and 4 correct
(E) Answer not known

2. Assertion [A] : Slew rate is the maximum rate of change of output voltage caused by a step input voltage.

Reason [R] : The operational amplifier has capacitors to prevent oscillations.

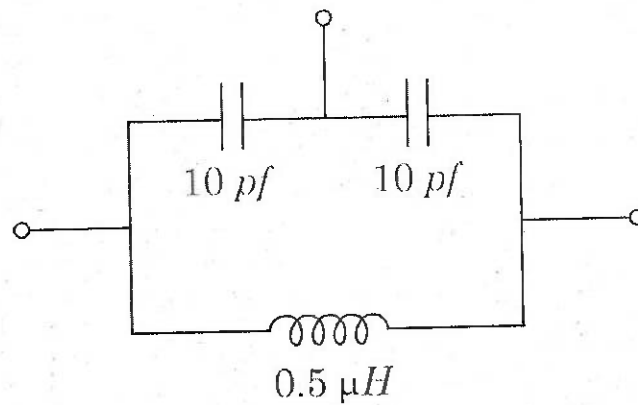
- ~~(A)~~ Both [A] and [R] are true; and [R] is the correct explanation of [A]
(B) Both [A] and [R] are true; and [R] is not the correct explanation of [A]
(C) [A] is false but [R] is true
(D) [A] is true but [R] is false
(E) Answer not known

3. The closed loop gain for the amplifier shown in figure is

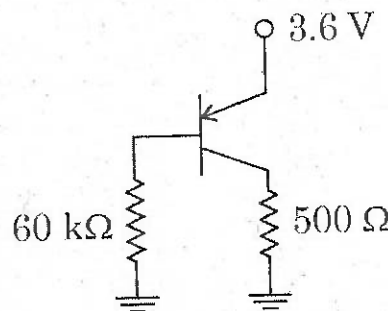


- (A) -99 ~~(B)~~ 100
(C) 99 (D) 120
(E) Answer not known

4. A tuned circuit used in Colpitts oscillator is shown in figure. The frequency of oscillators will be



- (A) 1 KHz
 (B) 1 MHz
 (C) 10 MHz
 (D) 100 MHz
 (E) Answer not known
5. In the circuit shown in figure BJT has current gain (β) of 50. For an emitter-base voltage $V_{EB} = 600$ mV, the emitter-collector voltage V_{EC} (in volts) is



- (A) 0 V
 (B) 3.6 V
 (C) 3 V
 (D) 2.85 V
 (E) Answer not known

6. Match List-I with List-II and select the correct answer using the codes given below

- List-I
- (a) BJT
 - (b) SCR
 - (c) FET
 - (d) DIAC

- List-II
- 1. Bilateral device
 - 2. Voltage controlled device
 - 3. Current controlled device
 - 4. Unilateral device

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 2 | 4 | 3 | 1 |
| (B) | 4 | 2 | 1 | 3 |
| (C) | 1 | 3 | 4 | 2 |
| (D) | 3 | 4 | 2 | 1 |
| (E) | Answer not known | | | |

7. For BJT, Match List-I with List-II and select the correct answer using the codes given below

- List-I
- (a) Emitter
 - (b) Base
 - (c) Collector
 - (d) Depletion region

- List-II
- 1. Lower concentration of free charge carriers
 - 2. Moderately doped region
 - 3. No free charge carriers
 - 4. Higher concentration of free charge carriers

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 2 | 3 | 4 | 1 |
| (B) | 4 | 1 | 2 | 3 |
| (C) | 2 | 4 | 1 | 3 |
| (D) | 4 | 3 | 2 | 1 |
| (E) | Answer not known | | | |

8. Which among the following is false specification of a single mode optical fibre?
- (A) Bandwidth is from 50 to 100 GHz/km
 - (B) More than 1,00,000 voice channels are available
 - (C) The mode field diameter is smaller than the core diameter
 - (D) Only light that strikes the fiber at an angle greater than critical angle gets propagated
 - (E) Answer not known
9. Logical addressing happens in _____ layer.
- (A) Physical
 - (B) Datalink
 - (C) Network
 - (D) Transport
 - (E) Answer not known
10. The rule used to give the estimation of the bandwidth of a frequency modulation system is
- (A) Faraday
 - (B) Armstrong
 - (C) Maxwell
 - (D) Carson
 - (E) Answer not known
11. In PAM signal, the distortion caused by the use of pulse amplitude modulation to transmit an analog information bearing signal is referred as
- (A) Equalizer effect
 - (B) Aperture effect
 - (C) Signal to Noise Ratio (SNR)
 - (D) Frequency modulation
 - (E) Answer not known

12. It is possible for the carrier component of FM to disappear completely. This happens for certain values of modulation index called
- (A) Critical δ_p value ~~(B)~~ Eigen values
 (C) Maximum δ_f value (D) Coupling co-efficient value
 (E) Answer not known

13. The window function

$$w(n) = \begin{cases} 0.5 - 0.5 \cos \frac{2\pi n}{M-1}, & 0 \leq n \leq M-1 \\ 0 & \text{otherwise} \end{cases}$$

is a causal window function of

- ~~(A)~~ Hanning window (B) Hamming window
 (C) Blackman window (D) Bartlett window
 (E) Answer not known

14. An analog filter is given by $H(s) = \frac{s+0.2}{(s+0.2)^2+9}$. Assuming $T = 1s$

convert it to digital filter

using impulse invariant technique

- ~~(A)~~ $H(z) = [1 + (0.8105)z^{-1}] / [1 + 1.6210z^{-1} + 0.6703z^{-2}]$
 (B) $H(z) = [1 + (3.1121)z^{-1}] / [8 + 4.12z^{-1} + 3.12z^{-2}]$
 (C) $H(z) = [1 + 0.018z^{-1}] / [1 + 8.92z^{-1} + 0.131z^{-2}]$
 (D) $H(z) = [1 + (2.1121)z^{-1}] / [8 + 2.12z^{-1} + 3.12z^{-2}]$
 (E) Answer not known

15. The maximum magnitude of the side lobe in window spectrum is -58 dB. The window function is

- (A) Kaiser window (B) Rectangular window
 (C) Hamming window ~~(D)~~ Blackman window
 (E) Answer not known

16. If the condition $h(t) * h^{-1}(t) = \delta(t)$ then the continuous LTI system is said to be
- (A) Causal (B) Stable
~~(C)~~ Invertible (D) Linear
 (E) Answer not known

17. A stable and causal LSI system with a rational system function has all of its poles and zeros inside the unit circle. Then the system is said to be
- ~~(A)~~ Minimum phase system (B) Feedback system
 (C) All pass filter (D) Dual drive system
 (E) Answer not known

18. The step response of $y(n) = x(n) + \frac{1}{12}y(n-1) + \frac{1}{12}y(n-2)$ is

~~(A)~~ $y(n) = \left[-\frac{2}{7} \left(\frac{1}{3} \right)^n + \frac{3}{35} \left(-\frac{1}{4} \right)^n + \frac{6}{5} \right] u(n)$

(B) $y(n) = \left[-\frac{1}{5} \left(\frac{1}{4} \right)^n + \frac{2}{12} \left(-\frac{1}{3} \right)^n + \frac{3}{4} \right] u(n)$

(C) $y(n) = \left[\frac{2}{7} \left(\frac{1}{3} \right)^n + \frac{2}{12} \left(-\frac{1}{3} \right)^n + \frac{6}{5} \right] u(n)$

(D) $y(n) = \left[+\frac{1}{5} \left(\frac{1}{4} \right)^n + \frac{3}{35} \left(-\frac{1}{4} \right)^n + \frac{3}{4} \right] u(n)$

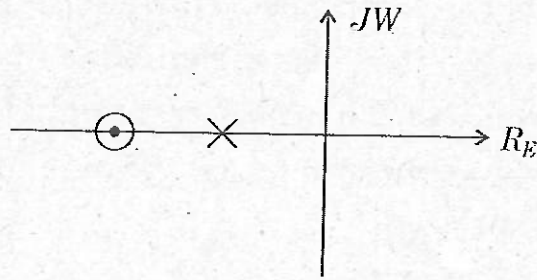
- (E) Answer not known

19. Radiation pyrometers are used in the temperature range of
- (A) 0 to 500°C (B) 500 to 1000°C
 (C) -250 to 500°C ~~(D)~~ 1200 to 3500°C
 (E) Answer not known

20. Operations of thermocouple is governed by
- (i) Peltier effect
 - (ii) Thompson effect
 - (iii) Seebeck effect
- (A) (i) and (ii) ~~(B)~~ (i), (ii) and (iii)
(C) (ii) and (iii) (D) (iii) and (i)
(E) Answer not known
21. The change in resistance for a 1 microstrain change is
- (A) 0.0024 Ω (B) 0.024 Ω
~~(C)~~ 0.00024 Ω (D) 0.24 Ω
(E) Answer not known
22. Vortex flow meter characteristics is poor at
- (A) High flow rates ~~(B)~~ Low flow rates
(C) Low and High flow rates (D) Medium flow rates
(E) Answer not known
23. V-notch is used to measure flow rate of liquid in
- ~~(A)~~ an open channel
(B) a non-circular cross-section closed channel
(C) vertical pipeline
(D) horizontal pipeline
(E) Answer not known
24. A conveyer belt is traveling at 19 cm/s, a load cell with a length of 1.1 m is reading 3.7 kgm. What is the flow rate of the material on the belt?
- (A) 1.95 kg/s ~~(B)~~ 0.64 kg/s
(C) 1.3 kg/s (D) 2.4 kg/s
(E) Answer not known

25. What force is required to accelerate a mass of 27 kg at 18 m/s^2 ?
- (A) 486 N (B) 386 N
(C) 286 N (D) 186 N
(E) Answer not known
26. Viscosity (dynamic) can be measured in _____, where as kinematic viscosity (without force) is measured in _____
- (A) Poise or Centipoise, Stokes or Centistokes
(B) Temperature, Pressure
(C) Pressure, Temperature
(D) Acceleration, Vibration
(E) Answer not known
27. Micromachined accelerometers make good vibration sensors for frequencies upto about
- (A) 15 KHz (B) 1 KHz
(C) 25 KHz (D) 50 KHz
(E) Answer not known
28. The SI unit for kinematic viscosity is
- (A) Nm/sec (B) m/sec^2
(C) m^2/sec (D) Nm^2/sec
(E) Answer not known

29. The pole-zero plot shown below in the figure is referred to



- (A) LAG Compensator (B) LEAD Compensator
 (C) LAG – LEAD Compensator (D) PID Controller
 (E) Answer not known

30. The phase crossover frequency of $G(s)H(s) = \frac{K}{s(s+1)(16s+1)}$ is

- (A) 1 rad/sec (B) 0.25 rad/sec
 (C) 4 rad/sec (D) 16 rad/sec
 (E) Answer not known

31. The closed loop transfer function of a system is,

$$\frac{C(s)}{R(s)} = \frac{1386}{s^3 + 18s^2 + 77s + 1386}$$

For this system, the number of roots that are in left side, right side and on JW AXIS of S-plane respectively

- (A) 2, 1, 0 (B) 1, 0, 2
 (C) 1, 2, 0 (D) 0, 1, 2
 (E) Answer not known

32. The error detector element in a control system gives
- (A) The sum of the reference signal and feedback signal
 - (B) The sum of the feedback signal and error signal
 - (C) The difference of the reference signal and feedback signal
 - (D) The difference of the reference signal and input signal
 - (E) Answer not known

33. The transfer function of a system is given by

$$\frac{100}{s^2 + 20s + 100}$$

The system is

- (A) an overdamped system
- (B) an underdamped system
- (C) an unstable system
- (D) a critically damped system
- (E) Answer not known

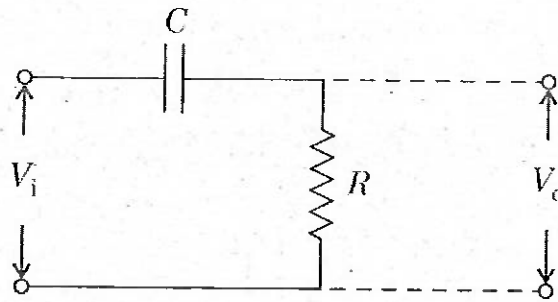
34. Given the transfer function $G(s) = \frac{121}{s^2 + 13.2s + 121}$ of a system. Which of the following characteristics does it have?

- (A) Underdamped with settling time 0.6 s
- (B) Overdamped with settling time 1.1 s
- (C) Critically damped with settling time 0.8 s
- (D) Underdamped with settling time 0.707 s
- (E) Answer not known

35. The system with open loop transfer function $G(s)H(s) = \frac{1}{s(s+1)}$ is

- (A) Type 2 order 1
- (B) Type 0 order 0
- (C) Type 1 order 2
- (D) Type 1 order 1
- (E) Answer not known

36. The transfer function of the network shown in figure



(A) $\frac{1}{1+SRC}$

~~(B)~~ $\frac{SRC}{1+SRC}$

(C) $\frac{RC}{1+SRC}$

(D) $\frac{1+SRC}{1-SRC}$

(E) Answer not known

37. Transfer function is defined as

~~(A)~~ The ratio of Laplace Transform of output to Laplace Transform of input considering initial condition is zero

(B) The ratio of Laplace Transform of input to Laplace Transform of output considering initial condition is zero

(C) The ratio of input to output

(D) The ratio of output to input

(E) Answer not known

38. Find the rank of the matrix $A = \begin{bmatrix} 3 & 9 & 2 \\ 1 & 3 & 0 \\ 2 & 6 & 1 \end{bmatrix}$

~~(A)~~ 2

(B) 3

(C) 1

(D) 9

(E) Answer not known

39. The transfer function of a system is

$$\frac{2s^2 + 6s + 5}{(s + 1)^2(s + 2)}$$

The characteristics equation of the system is

- (A) $2s^2 + 6s + 5 + (s + 1)^2(s + 2) = 0$
- (B) $2s^2 + 6s + 5 = 0$
- ~~(C)~~ $(s + 1)^2(s + 2) = 0$
- (D) $2s^2 + 6s + 5 - (s + 1)^2(s + 2) = 0$
- (E) Answer not known

40. Find the true statements of DCS :

- (i) DCS systems have evolved into systems providing very sophisticated analog control capability.
 - (ii) The data highway is normally capable of high speeds typically 1 Mbps upto 10 Mbps.
 - (iii) DCS provides with easy system configurations and operator control.
- (A) (i) only
 - (B) (i) and (ii) only
 - (C) (ii) and (iii) only
 - ~~(D)~~ (i), (ii) and (iii) only
 - (E) Answer not known

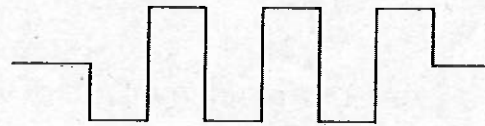
41. Which of the following is a type of device that is commonly used as a HART slave?

- (A) Controller
- (B) Sensor
- (C) Actuator
- ~~(D)~~ Transmitter
- (E) Answer not known

42. How many input and output pins do a nano programmable logic controller have?

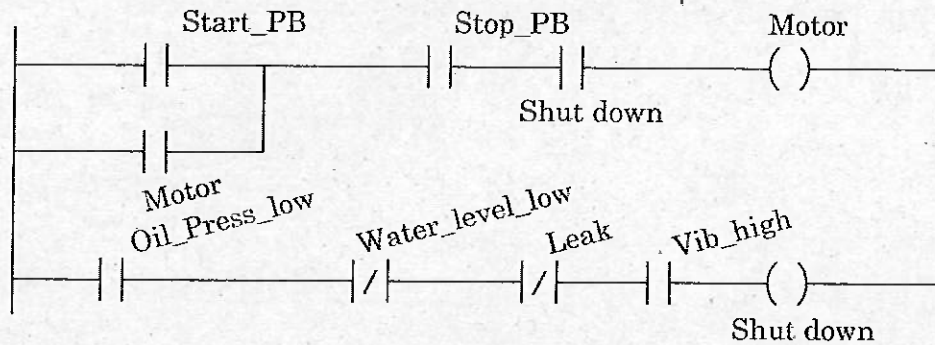
- (A) 16
- (B) 30
- (C) 50
- (D) 128
- (E) Answer not known

43. In Ladder logic, the given symbol is used to indicate _____.



- (A) Fuse
- (B) Heating element
- (C) Relay coil
- (D) Flow Switch
- (E) Answer not known

44. In the PLC ladder diagram identify and correct the error.



- (A) The start - PB contact instruction should be drawn as normally closed
- (B) The stop - PB contact instruction should be drawn normally closed
- (C) Oil pressure low contact instruction should be drawn normally closed
- (D) Water - level - low contact instruction should be drawn as normally open
- (E) Answer not known

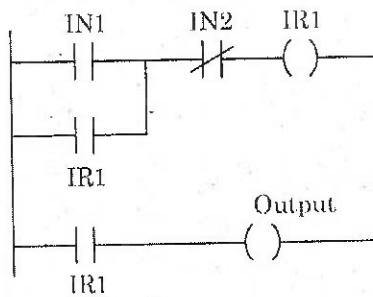
45. The logic ladder program is entered and stored in

- (A) user program
- (B) data table
- (C) housekeeping memory
- (D) subvert data space
- (E) Answer not known

46. _____ is not a typical output module of PLC.

- (A) LED display
- (B) Indicator lights
- (C) Push buttons
- (D) Solenoid valves
- (E) Answer not known

47. When the program instructions LDX400, PLSM100 of Mitsubishi are used for a ladder rung, the internal relay M100 will



- (A) Remain on when the input to X100 ceases
- (B) Remain on when there is a pulse input to X100
- (C) Remain on for one program cycle when there is an input to X100
- (D) Remain on for one program cycle after the input to X100 ceases
- (E) Answer not known

48. The I²C (Inter IC connect) standards are

(i) Industrial 100 kbps I²C

(ii) 100 kbps SM I²C

(iii) 400 kbps I²C

(iv) 800 kbps I²C

(A) (i) and (iv)

(B) (i) and (iii)

(C) (i), (ii), (iii) and (iv)

~~(D)~~ (i), (ii) and (iii)

(E) Answer not known

49. Assertion [A] : I²C bus is a standard bus which follows a Communication protocol and is used between multiple ICs

Reason [R] : This bus permits a system to get data and send data to multiple compatible ICs connected on this bus.

(A) [A] is true but [R] is false

~~(B)~~ Both [A] and [R] are true ; and [R] is the correct explanation of [A]

(C) [A] is false, [R] is true

(D) Both [A] and [R] are true ; but [R] is not the correct explanation of [A] is correct

(E) Answer not known

50. Multiprocessor systems uses two or more processors or that uses dual or multiple cores for faster execution of the

(i) program functions and tasks

(ii) single or multiple data instructions

(iii) very long instruction words

(A) (i) and (ii)

(B) (i) only

(C) (ii) only

~~(D)~~ (i), (ii) and (iii)

(E) Answer not known

51. A D/A converter has a full scale analog output of 10 V and accepts 6 binary bits as inputs. Find the voltage corresponding to each analog step.

(A) $\frac{2}{63}$ V

(B) $\frac{4}{63}$ V

(C) $\frac{8}{63}$ V

~~(D)~~ $\frac{10}{63}$ V

(E) Answer not known

52. An Astable multivibrator uses a resistance of 100 k Ω and capacitance of 0.01 μ F. The frequency of square waves generated by it is

(A) 924 Hz

(B) 593 Hz

~~(C)~~ 693 Hz

(D) 110 Hz

(E) Answer not known

53. For a 3-BIT DAC with "0 V" to "8 V" Analog output range, the value of LSB is

(A) 0 V

~~(B)~~ 1 V

(C) 2 V

(D) 0.625 V

(E) Answer not known

54. The Full Adder is made up of

~~(A)~~ Two half adders and one OR Gate

(B) One half adders and two OR Gates

(C) Two half adders and two OR Gates

(D) Two half adders and one AND Gate

(E) Answer not known

64. The dynamic characteristics of capacitive transducers are similar to those of
- (A) Low-pass filters ~~(B)~~ High-pass filters
(C) Notch filters (D) Band stop filters
(E) Answer not known
65. A Piezoelectrical transducer has an output voltage of 3V at no load conditions. It has a capacitance of 250 pf. It is connected to load capacitance of 125 pf. Find the voltage across the load at high frequencies.
- (A) 1 V ~~(B)~~ 2 V
(C) 4 V (D) 9 V
(E) Answer not known
66. The test inputs applied to the transducer to determine its dynamic behaviour are
- (i) Impulse input and step input
(ii) Ramp input and Parabolic input
(iii) Sinusoidal input
- (A) (i) and (ii) (B) (i) only
~~(C)~~ (i), (ii) and (iii) (D) (ii) only
(E) Answer not known
67. One of the following can act as an Inverse transducer
- (A) Electrical resistance potentiometer
(B) LVDT
(C) Capacitive transducer
~~(D)~~ Piezo electric crystals
(E) Answer not known

68. The different type of static errors commonly are

- (i) Accuracy, sensitivity
- (ii) Reproducibility, Drift
- (iii) Static error, Dead zone

(A) (i) and (ii)

~~(B)~~ (i), (ii) and (iii)

(C) (i) and (iii)

(D) (ii) and (iii)

(E) Answer not known

69. A (0 - 300 V) voltmeter has an error of $\pm 2\%$ of full scale deflection. What would be the range of readings if true voltage is 30 V?

~~(A)~~ 24 V - 36 V

(B) 29.4 V - 30.6 V

(C) 20 V - 40 V

(D) 30 V - 40 V

(E) Answer not known

70. The current of a circuit is measured by a moving coil instrument having weak spring used for producing controlling torque, thereby causing errors in current measurement. This error may be called

(A) Residual error

(B) Gross error

(C) Error caused by loading effect

~~(D)~~ Instrumental error

(E) Answer not known

71. A Wattmeter has a full scale range of 2500 W. It has an error $\pm 1\%$ of true value. What would be the range of reading if true power is 1250 W?

(A) 1225.5 W - 1275.5 W

(B) 1245.5 W - 1255.5 W

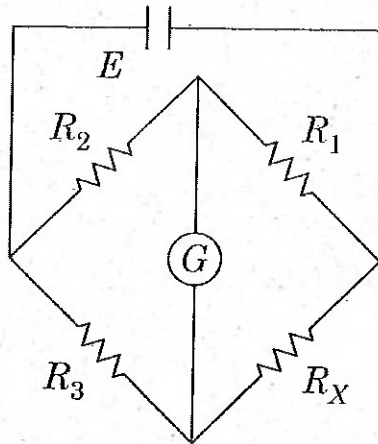
(C) 1200 W - 1300 W

~~(D)~~ 1237.5 W - 1262.5 W

(E) Answer not known

76. A moving coil galvanometer has a resistance of 4Ω , and gives full scale deflection when carrying 30 mA. The instrument can be used to measure 150 V by connecting in series with the instrument a resistance of
- (A) 9996Ω (B) 5004Ω
(C) 5000Ω ~~(D) 4996Ω~~
(E) Answer not known
77. A simple slide wire is used for measurement of current in a circuit. The voltage drop across standard resistor of 0.1Ω is balanced at 80 cm. Find the magnitude of current if the standard cell emf of 1.5 V is balanced at 50 cm.
- (A) 21.75 A ~~(B) 24 A~~
(C) 2.4 A (D) 3 A
(E) Answer not known
78. Current in the RF range is measured by
- (A) Simple ammeter
~~(B) Ammeter using thermo couples~~
(C) Multi range ammeters
(D) Ayrton shunt
(E) Answer not known
79. In megohm bridge the high resistance are provided with a guard terminal. This guard terminal is used to
- ~~(A) Bypass the leakage current~~
(B) Guard the resistance against stray electrostatic fields
(C) Guard the resistance against over loads
(D) Guard the resistance against corrosion
(E) Answer not known

80. What is the balance equation of kelvin bridge?



(A) $R_X = \frac{R_2 R_3}{R_1}$

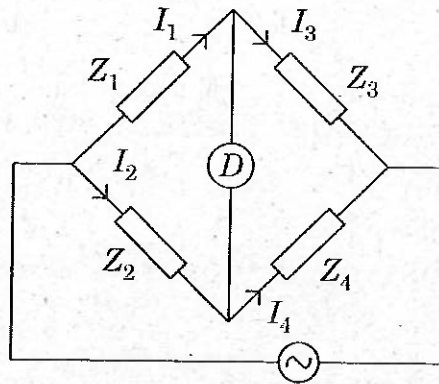
(B) $R_X = \frac{R_1 R_2}{R_3}$

(C) $R_X = \frac{R_1}{R_2}$

~~(D)~~ $R_X = \frac{R_1 R_3}{R_2}$

(E) Answer not known

81. For the bridge shown in fig $Z_1 = 200 \Omega \angle 30^\circ$ $Z_2 = 100 \Omega \angle 0^\circ$, $Z_3 = 250 \Omega \angle -40^\circ$. In order that the bridge is balanced Z_4 should be



(A) $187.5 \angle -70^\circ \Omega$

(B) $125 \angle +70^\circ \Omega$

~~(C)~~ $125 \angle -70^\circ \Omega$

(D) $187.5 \angle +70^\circ \Omega$

(E) Answer not known

82. Name the diagnostic imaging procedure in which anatomical information is digitally reconstructed from X-ray transmission data obtained by scanning an area from many directions in the same plane to visualize information in that plane

- (A) Computed Tomography (CT)
- (B) Computed Radiography
- (C) Magnetic Resonance Imaging (MRI)
- (D) Position Emission Tomography (PET)
- (E) Answer not known

83. Identify the correct statement

Statement A : A CT scanner uses ionizing radiation, X-Rays, to acquire its images.

Statement B : CT scanner is best suited for soft (Non-calcified) tissue exams.

- (A) Both statement A, statement B are correct statement B is correct explanation of statement A.
- (B) Both statements are correct. But statement B is not correct explanation of statement A.
- (C) Statement A is true, but B is false
- (D) Statement A is false, but B is true.
- (E) Answer not known

84. Match the following relevant to interpretation of ECG :

- | | |
|--------------------------------------|-------------------------------|
| (a) Slower heart beat | 1. Tachycardia |
| (b) Higher heart beat | 2. Arrhythmic |
| (c) PR interval greater than 0.2 sec | 3. Bradycardia |
| (d) QRS | 4. Ventricular depolarization |

- | | | | |
|--|-----|-----|-----|
| (a) | (b) | (c) | (d) |
| <input checked="" type="radio"/> (A) 3 | 1 | 2 | 4 |
| (B) 3 | 1 | 4 | 2 |
| (C) 1 | 3 | 2 | 4 |
| (D) 1 | 2 | 3 | 4 |
| (E) Answer not known | | | |

85. The carrier gas used in gas chromatograph when thermal conductivity detection is employed are _____ and _____

- (A) Hydrogen and nitrogen (B) Nitrogen and Helium
~~(C)~~ Helium and Hydrogen (D) Hydrogen and CO₂
(E) Answer not known

86. The various components of a mass spectrometer are

- ~~(A)~~ The ion source, mass analyser and Vacuum system
(B) A/D converter, mass analyser and D/A converter
(C) Sampler, mass analyser and display
(D) Mass analyser, ADA converter and display
(E) Answer not known

87. Spectroscopy deals with interaction of electromagnetic radiation with matter. What is the speed of this radiation in Vacuum in m/s?

- (A) 6×10^8 (B) 5×10^8
~~(C)~~ 3×10^8 (D) 7×10^8
(E) Answer not known

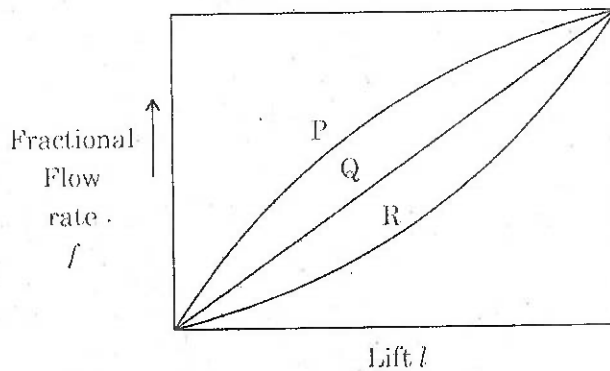
88. Consider the statements related to beer's law of absorbance

- (1) Absorbance and concentration is linear for low concentration level of compound in samples.
- (2) Absorbance and concentration is not linear for high concentration level of compound samples.
- (3) Absorbance and concentration always linear
- (4) The absorbance is logarithmic calculation of incident to transmitted intensity.

Which of the following are correct?

- (A) (3) and (4) (B) (1), (2) and (4)
(C) (3) only ~~(D)~~ (1) and (2)
(E) Answer not known

89. The inherent control valve characteristics for three valve trims is shown in figure. Choose the correct valve trim with its characteristics.



- (A) P-Square root, Q-Linear, R-Equal percentage
 (B) P-Linear, Q-Square root, R-Equal percentage
 (C) P-Equal percentage, Q-Linear, R-Square root
 (D) P-Square root, Q-Equal percentage, R-Linear
 (E) Answer not known
90. Adaptive gain is used for controlling processes.
- (A) Non-linear
 (B) Time-variant
 (C) Dead time
 (D) Fast
 (E) Answer not known
91. For applications requiring precise flow control, the best suited valve type is
- (A) Globe valve
 (B) Butterfly valve
 (C) Diaphragm valve
 (D) Needle valve
 (E) Answer not known
92. Which of the following types of control valves is best suited for applications requiring high flow rates and low pressure drops?
- (A) Globe valve
 (B) Butterfly valve
 (C) Diaphragm valve
 (D) Ball valve
 (E) Answer not known

93. Choose the truthful statements from the following functions of controllers :

1. Proportional control – Accelerates the response of a controlled process and produces an offset
2. Integral control – Anticipates future errors and introduces appropriate action
3. Derivative control – Produces sluggish and long oscillating responses
4. PID control – Increases the speed of the closed loop response and retain robustness.

- (A) 1 and 2 only ~~(B)~~ 1 and 4 only
(C) 4 and 2 only (D) 2 and 3 only
(E) Answer not known

94. Which model is processed in Cohen-Coon turning parameter?

- (A) First order + Dead time
(B) Second order + Dead time
~~(C)~~ First order + Time delay
(D) Second order + Time delay
(E) Answer not known

95. If response of a control system is to be free of offset and oscillation, the most suitable controller is

- (A) Proportional controller
(B) Proportional – Derivative Controller (PD)
(C) Proportional – Integral (PI) Controller
~~(D)~~ Proportional – Integral – Derivative (PID) Controller
(E) Answer not known

99. A gas in a closed volume has a pressure of 150 Psi as a temperature of 20°C ————— is the pressure at 100°C

(A) $P_2 \simeq 155$ Psi

(B) $P_2 \simeq 175$ Psi

(C) $P_2 \simeq 250$ Psi

~~(D)~~ $P_2 \simeq 191$ Psi

(E) Answer not known

100. In the self regulator process, the q is increases, then the P_s will

~~(A)~~ Increases

(B) Decreases

(C) Either increases or decreases

(D) Maintained at constant

(E) Answer not known

101. For two non-interacting first order systems connected in series, the over all transfer function is the ————— of the individual transfer functions.

~~(A)~~ Product

(B) Ratio

(C) Sum

(D) Difference

(E) Answer not known

102. A frequency divider used in a modern signal generator

- (A) divides the frequency by 2
- (B) doubles the frequency
- (C) divides the frequency by 10
- (D) multiply the frequency by 2
- (E) Answer not known

103. In a phase shift oscillator, if the frequency is doubled, the resistance to be included is

- (A) Doubled
- (B) Halved
- (C) Same
- (D) Squared
- (E) Answer not known

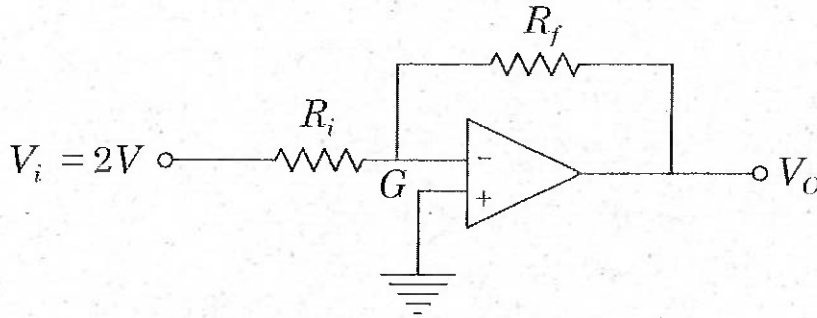
104. For a differentiator using operational amplifier, A square wave input of 1 KHz frequency is given at the inverting terminal. The output of the differentiator will be

- (A) Zero
- (B) Spike pulses
- (C) Square wave
- (D) Triangular wave
- (E) Answer not known

105. A differential amplifier has common mode signal voltage of 0.2 V, differential and common mode gains of 80 and 0.1, respectively. Then the CMRR will be

- (A) 8
- (B) 16
- (C) 400
- (D) 800
- (E) Answer not known

106. Output voltage in an inverting amplifier



$$R_i = 1 \text{ k}\Omega$$

$$R_f = 3 \text{ k}\Omega$$

- (A) $-2V$ (B) $-4V$
(C) $-6V$ (D) $-8V$
(E) Answer not known

107. The frequency of oscillation of an elementary LC oscillatory circuit depends on

- (A) Coil resistance
(B) Self inductance of the coil
(C) Capacitance of the capacitor
(D) Both (B) and (C)
(E) Answer not known

108. The drain to source capacitance in small signal high frequency model of FET is in the order of

- (A) 0.5 pF (B) 5 pF
(C) 50 pF (D) 500 pF
(E) Answer not known

109. For high frequency applications MOSFETs, are preferred over BJT because BJT has

- (A) lower switching loss but higher conduction loss
- ~~(B)~~ higher switching loss but lower conduction loss
- (C) higher switching loss and higher conduction loss
- (D) lower switching loss and lower conduction loss
- (E) Answer not known

110. In the cut-off region of a BJT

- ~~(A)~~ both base-emitter and collector-base are reverse biased
- (B) base-emitter forward biased and collector-base reverse biased
- (C) base-emitter reverse biased and collector-base forward biased
- (D) both base-emitter and collector-base are forward biased
- (E) Answer not known

111. FET has offset voltage about

- (A) 0.2 V
- (B) 0.6 V
- (C) 1.1 V
- ~~(D)~~ Zero
- (E) Answer not known

112. Choose the correct sequence of the given steps followed in the fabrication of monolithic transistors

1. Base diffusion
 2. Emitter diffusion
 3. Epitaxial growth
 4. Water/Substrate preparation
- (A) 3, 4, 1, 2
 - ~~(B)~~ 4, 3, 1, 2
 - (C) 3, 4, 2, 1
 - (D) 2, 1, 3, 4
 - (E) Answer not known

113. Which of the following statements are true regarding SCR?

- (i) Latching current associated with turn on process
 - (ii) Holding current associated with turn off process
 - (iii) Holding and latching currents should be equal
 - (iv) Holding current is higher than latching current
- (A) (i) and (iv) only
(B) (ii) and (iii) only
(C) (i), (ii) and (iv) only
~~(D) (i) and (ii) only~~
(E) Answer not known

114. Secondary breakdown will not occur in

- (A) BJT
(B) BJT but in MOSFET
~~(C) MOSFET~~
(D) both MOSFET and BJT
(E) Answer not known

115. ASK is a digital modulation technique defined as the process of

- (A) Shifts amplitude and frequency between two levels according to the digital message
(B) Shifts amplitude and phase between two levels according to the digital signal
~~(C) Shifting amplitude of carrier between two levels according to digital message~~
(D) Shifting frequency and phase between two levels according to amplitude of digital message
(E) Answer not known

116. According to Nyquist's sampling rate, the minimum is
- (A) $f_s = 2w$ (B) $f_s = w/2$
 (C) $f_s = 3w$ (D) $f_s = w^2$
 (E) Answer not known
117. The line connecting the positive and negative peaks of the carrier waveform is called
- (A) Modulation index
 (B) Maximum amplitude ceiling
 (C) Envelope
 (D) Peak lines
 (E) Answer not known
118. _____ are suitable for demodulating vestigial side band signals.
- (A) Hall effect devices (B) Singing Suppressors
 (C) Line finder (D) Envelope detectors
 (E) Answer not known
119. In a FM system when the audio frequency is 500 Hz and the AF voltage is 2.4 V, the deviation is 4.8 KHz. Calculate modulation index
- (A) 0.5 (B) 2
 (C) 9.6 (D) 4.8
 (E) Answer not known
120. Using FFT algorithm, for $N = 4$ the sequence $x(n) = \cos \frac{n\pi}{2}$ would be
- (A) $X(K) = \{0, 0, 2, 2\}$ (B) $X(K) = \{2, 2, 0, 0\}$
 (C) $X(K) = \{0, 2, 0, 2\}$ (D) $X(K) = \{2, 0, 2, 0\}$
 (E) Answer not known

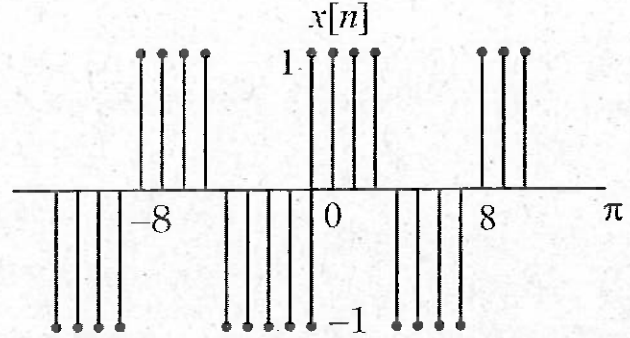
121. A signal having a spectrum ranging from near DC to 10 KHz is to be sampled and converted to discrete form. What is the minimum number of samples per second that must be taken to ensure recovery?

- (A) 200 samples/sec
- (B) 2000 samples/sec
- ~~(C)~~ 20,000 samples/sec
- (D) 2,00,000 samples/sec
- (E) Answer not known

122. Energy of the signal $nu[n]$ is

- (A) $\frac{n(n+1)}{2}$
- (B) $\frac{n(n+1)(2n+1)}{6}$
- (C) $\left(\frac{n(n+1)}{2}\right)^2$
- ~~(D)~~ ∞
- (E) Answer not known

123. Which among the following is the fundamental frequency of the discrete time square wave shown below?



- (A) $\frac{\pi}{2}$ radians
- (B) $\frac{\pi}{3}$ radians
- ~~(C)~~ $\frac{\pi}{4}$ radians
- (D) π radians
- (E) Answer not known

124. _____ is used to measure relatively high temperatures, such as encountered in furnaces

- (A) Bolometer
- (B) ~~Pyrometer~~
- (C) Anemometer
- (D) Gas-Analyzer
- (E) Answer not known

125. Bridman gauges are used for measurement of

- (A) Vacuum
- (B) Medium pressures
- (C) High pressures
- (D) ~~Very High Pressures~~
- (E) Answer not known

126. The limitation of a thermocouple is

- (A) Availability of material used
- (B) Range of temperature
- (C) ~~Heaters can withstand only small overload~~
- (D) Life time
- (E) Answer not known

127. For measuring temperature in the range of 3000°C , the following transducer is used

- (A) RTD
- (B) Thermocouple
- (C) ~~Pyrometer~~
- (D) Thermistor
- (E) Answer not known

128. The conversion takes place in bourdon tube is

- (A) ~~Pressure to displacement~~
- (B) Pressure to voltage
- (C) Pressure to strain
- (D) Pressure to force
- (E) Answer not known

129. Consider the following statements related to flow meter's :

1. Hot wire anemometer is unsuitable for velocity measurement if fluid is conducting liquid.
2. Electromagnetic flow meter can be used for measurement of bidirectional flow.
3. Electromagnetic flow meter is capable of measuring the rate of flow and totalized flow.
4. Turbine flow meter has a good dynamic response.

Which of the following are correct?

- (A) 1, 2, 3 and 4 (B) 1, 2 and 3
(C) 2, 3 and 4 ~~(D) 1, 2 and 4~~
(E) Answer not known

130. A flow meter that can be suitable for flow measurement of slurries, greasy materials and liquids containing suspended matter is

- (A) Venturimeter (B) Orifice meter
~~(C) Electromagnetic flow meter~~ (D) Anemometer
(E) Answer not known

131. Identify from the following the instrument does not come under pressure measurement

- (A) Manometer (B) Bourdon tube
~~(C) Venturi meter~~ (D) Ionization gauge
(E) Answer not known

132. Which of the following technique can be used to obtain controlling torque in a moving iron instrument?

- (A) Air friction (B) Fluid friction
(C) Eddy current ~~(D) Spring control~~
(E) Answer not known

133. The features of Piezo-Electric Accelerometers are :

1. The natural frequency is very high.
 2. Due to high natural frequency, it is used for high frequency applications.
 3. The response to low frequencies is good.
- (A) 1 and 2 are correct (B) 2 and 3 are correct
(C) 3 and 1 are correct (D) 1, 2, 3 are correct
(E) Answer not known

134. Among the following, which plot is used to design a compensator with specifications of phase margin ϕ_{pm} and band width ω_b ,

1. Nyquist Plot
 2. Bode Plot
 3. Nichols Plot
- (A) 1 only (B) 1 and 2 only
(C) 1 and 3 only (D) 2 and 3 only
(E) Answer not known

135. A phase-lead compensator has the transfer function,

$$G_c(s) = \frac{20(1 + 0.04s)}{1 + 0.01s}$$

The maximum phase angle lead provided by this compensator will occur at a frequency ω_n and is equal to _____ RAD/SEC.

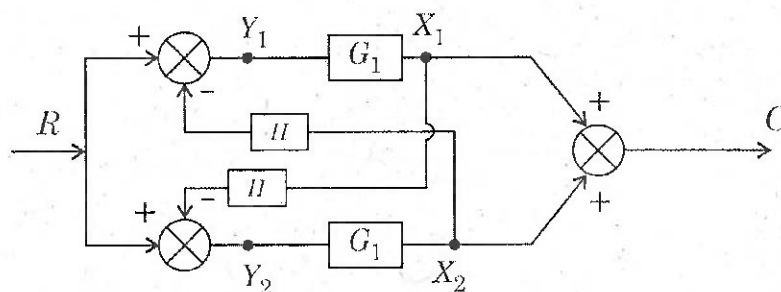
- (A) 20 (B) 50
(C) 40 (D) 10
(E) Answer not known

139. Match the location of poles/zeros in the S-plane listed in Group – I with the system response characteristic in Group – II :

- | Group – I | | Group – II | |
|-----------|--------------------------------------|------------|----------------------|
| (a) | Poles in the right half of the plane | 1. | Stable Response |
| (b) | Pole at the origin | 2. | Inverse Response |
| (c) | Zero in the right half of the plane | 3. | Integrating Response |
| (d) | Poles in the left half of the plane | 4. | Unstable Response |

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 2 | 3 | 4 | 1 |
| (B) | 4 | 3 | 2 | 1 |
| (C) | 3 | 1 | 4 | 2 |
| (D) | 4 | 3 | 1 | 2 |
| (E) | Answer not known | | | |

140. For the block diagram given below, _____ is the overall transfer function :



- | | | | |
|-----|---------------------------|----------------|--------------------------|
| (A) | $\frac{G_1}{1 - G_1 H}$ | (B) | $\frac{2G_1}{1 - G_1 H}$ |
| (C) | $\frac{G_1 H}{1 - G_1 H}$ | (D) | $\frac{2G_1}{1 - H}$ |
| (E) | Answer not known | | |

141. A unity feedback control system has an open loop system transfer function of $G(s) = \frac{2(s+8)}{s(s+2)}$, the closed loop transfer function is

(A) $\frac{C(s)}{R(s)} = \frac{s+8}{s^2+4s+16}$

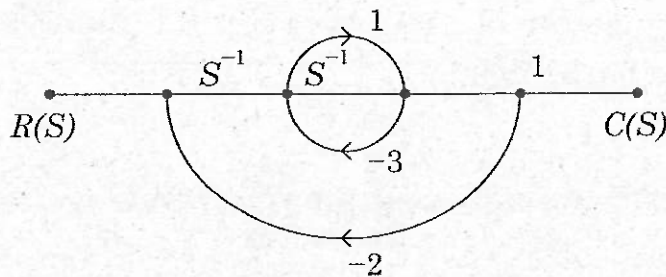
(B) $\frac{C(s)}{R(s)} = \frac{s(s+8)}{s^2+16s+4}$

(C) $\frac{C(s)}{R(s)} = \frac{2}{s^2+4s+16}$

~~(D)~~ $\frac{C(s)}{R(s)} = \frac{2(s+8)}{s^2+4s+16}$

(E) Answer not known

142. The signal flow graph of a system is shown below. Find the transfer function, $\frac{C(S)}{R(S)}$



(A) $\frac{S+1}{5S^2+4S+2}$

(B) $\frac{S+1}{S^2+4S+2}$

~~(C)~~ $\frac{S+1}{4S^2+5S+2}$

(D) $\frac{S}{5S^2+4S+2}$

(E) Answer not known

143. In SCADA, mention the Type of ADC having very low frequency, More Accurate, Greater Noise Immunity and Slowest
- (A) Successive approximation ADC
 - (B) Integrating or Dual slope ADC
 - (C) Parallel Comparator ADC
 - (D) Counting type ADC
 - (E) Answer not known
144. Communication channel, the _____ of channel limits the _____ of communication in SCADA.
- (A) Bandwidth, Velocity
 - (B) Bandwidth, Speed
 - (C) Speed, Velocity
 - (D) Speed, Bandwidth
 - (E) Answer not known
145. In SCADA system, the communication system refers
- (A) Communication channel between field equipment and RTU
 - (B) Communication channel between different field equipments
 - (C) Communication channel employed between field equipments and master station
 - (D) Communication channel between RTU and master station
 - (E) Answer not known
146. Selection of RTU for a process plant depends on
- (i) Capacity
 - (ii) Communication ports
 - (iii) NURAM
 - (iv) Watchdog timer
- (A) (i) and (ii) only
 - (B) (i) and (iii) only
 - (C) (i), (ii), (iii) and (iv)
 - (D) (ii) and (iii) only
 - (E) Answer not known

147. Each horizontal line in a ladder diagram is referred to as

- (A) Period
- (B) Group
- (C) Row
- ~~(D) Rung~~
- (E) Answer not known

148. Bool tag in programmable logic controller

- (A) Represents times memory
- (B) Is used in PID controller functions
- ~~(C) Holds true or false values~~
- (D) Represents counter memory
- (E) Answer not known

149. PLC operates on the following signal

- ~~(A) Digital~~
- (B) Impulse
- (C) Analog
- (D) Frequency
- (E) Answer not known

150. In PLC, when a relay is NOT energised, _____

- (A) there is on electrical path through NO contacts
- (B) there is on electrical path through NC contacts
- ~~(C) neither the NO or the NC contact have electrical path~~
- (D) both NO and NC contacts have an electrical path
- (E) Answer not known

151. If the following which is not an input module of a PLC

- (A) Push buttons
- (B) Selector switches
- (C) Limit switches
- ~~(D) LED displays~~
- (E) Answer not known

155. Which of the following is not a characteristics of a cisc system?

- (A) Complex instruction
- (B) Fast hardware
- ~~(C)~~ Low hardware budget
- (D) Fast execution
- (E) Answer not known

156. What is the primary function of a Microprocessor?

- (A) Digital signal processing
- (B) Control external devices
- ~~(C)~~ Executive program instructions
- (D) Perform complex mathematical calculations
- (E) Answer not known

157. A digital to analog converter uses a

- (A) Inductive ladder
- (B) Capacitor ladder
- (C) Resistive and inductive ladder
- ~~(D)~~ Resistive ladder
- (E) Answer not known

158. _____ is the LSB, MSB and full scale output for an 8-Bit DAC for the 0 to 10 V range.

- (A) 10 mV, 2.5 V, 4.5 V
- (B) 80 mV, 5 V, 7.5 V
- (C) 39 mV, 10 V, 9.9 V
- ~~(D)~~ 39 mV, 5 V, 9.9 V
- (E) Answer not known

162. The Minimum number of flip-flops required to design a MOD-12 counter is

- ~~(A)~~ 4 (B) 3
(C) 12 (D) 1
(E) Answer not known

163. The modes of operation of Piezoelectric crystals are

- (i) Thickness shear
(ii) Thickness expansion
(iii) Face shear
(iv) Transverse expansion
(A) (i) and (ii) only (B) (ii) and (iii) only
~~(C)~~ (i), (ii), (iii) and (iv) (D) (iii) and (iv) only
(E) Answer not known

164. The variable inductance transducers work, generally, upon the principles

- (i) change of self inductance
(ii) change of mutual inductance
(iii) production of eddy currents
(A) (ii) only ~~(B)~~ (i), (ii) and (iii)
(C) (iii) only (D) (i) only
(E) Answer not known

165. In a variable inductive transducer, the coil has an inductance of 2.5 mH when the effective turns on the coil is 50. Determine the inductance of the coil when the measurand makes the effective turns on the coil is 52.

- (A) 2.40 mH (B) 2.6 mH
~~(C)~~ 2.704 mH (D) 27.04 mH
(E) Answer not known

166. Which of the following is true?

- (1) An optical interferometer is useful for measuring extreme small motion
(2) The damping ratio of a seismic instrument should be low for good dynamic performance
(3) A rate Gyro is a relative motion measuring device
(4) A pneumatic motion transducer is non-linear over a wide range of motion
- (A) (1) and (2) only (B) (2) and (3) only
~~(C)~~ (1) and (4) only (D) (2) and (4) only
(E) Answer not known

167. A Hall effect transducer is used for measurement of magnetic field of 1.5 Wb/m^2 with a copper transducer for which the Hall effect co-efficient is $-52 \times 10^{-12} \text{ V.M./A.wb.m}^{-2}$. The thickness of element is 2 mm and current passing is 5 A. Find the voltage generated

- ~~(A)~~ $-0.195 \mu\text{V}$ (B) $0.195 \mu\text{V}$
(C) -390 mV (D) $-390 \times 10^{-9} \text{ V}$
(E) Answer not known

168. Match the following Static performance parameters :

- | | |
|-----------------|--|
| (a) Precision | 1. Gradual departure of the instrument O/P from the calibrated value |
| (b) Calibration | 2. Smallest increment in measurand that can be detected with certainty by the instrument |
| (c) Resolution | 3. The act of making adjustments on the scale according to the standard |
| (d) Drift | 4. The ability of the device to give identical output when repeat measurements are made |

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 4 | 1 | 2 | 3 |
| (B) | 2 | 1 | 4 | 3 |
| (C) | 4 | 3 | 2 | 1 |
| (D) | 3 | 4 | 1 | 2 |
| (E) | Answer not known | | | |





169. Standards in Transducer Engineering are classified as

- (i) International standards
 - (ii) Primary standards
 - (iii) Secondary standards
 - (iv) Working standards
- | | |
|--|--------------------|
| (A) (i), (ii), (iii) and (iv) | (B) (i) and (ii) |
| (C) (ii) and (iii) | (D) (iii) and (iv) |
| (E) Answer not known | |

170. The fundamentals units are

- | | |
|----------------------|--------------------------------------|
| (A) Length | (B) Mass |
| (C) Time | (D) Length, Mass and Time |
| (E) Answer not known | |

171. Consider the Lissajous pattern on cathode ray tube with its phase shift. Which of the following are incorrectly paired?

- (1)  – Phase difference between the two equal voltages of same frequency is $\phi = 180^\circ$
- (2)  – Phase difference between the two equal voltages of equal frequency is $90^\circ < \phi < 180^\circ$
- (3)  – Phase difference between the two equal voltages of different frequency is $\phi = 90^\circ$
- (4)  – Phase difference between the two voltages is $\phi = 0^\circ$
- (A) (1) and (3)
- (B) (2) and (3)
- (C) (1) and (2)
- (D) (2) and (4)
- (E) Answer not known

172. A $4\frac{1}{2}$ digital voltmeter is used for voltage measurements. Find its resolution in percentage.

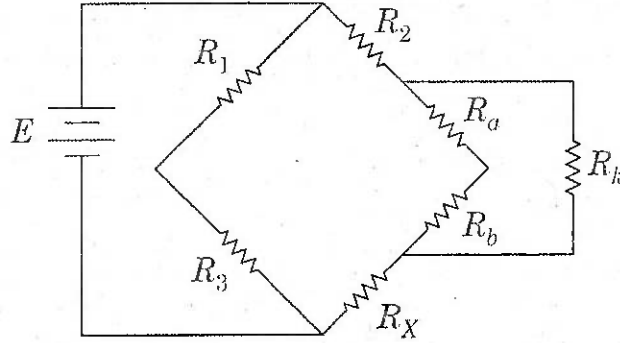
- (A) 0.1% (B) 0.005%
- (C) 0.01% (D) 1.0%
- (E) Answer not known

173. Period measurement is done in frequency meters for achieving high accuracy in the case of

- (A) High frequencies (B) Medium frequencies
- (C) D.C. (D) Low frequencies
- (E) Answer not known

174. A vibration galvanometer, is tuned by
- (A) changing the length and tension of the vibrating coil
 - (B) attaching weight to the vibrating coil
 - (C) changing the damping constant
 - (D) (A), (B) and (C)
 - (E) Answer not known
175. The multiplying powers of a shunt of 200Ω resistance used with a Galvanometer of 1000Ω resistance is
- (A) 2
 - (B) 4
 - (C) 6
 - (D) 8
 - (E) Answer not known
176. In Electrodynamometer wattmeter power measurement circuit having a low power factor because of
- (A) the current coil should be connected on the load side
 - (B) the current coil should be connected on the supply side
 - (C) the pressure coil should be connected on the load side
 - (D) a compensated wattmeter with pressure coil connected on the load side should be used
 - (E) Answer not known
177. The standardization of AC potentiometers is done by
- (A) Directly using AC standard voltage source
 - (B) Using DC standard sources and transfer instrument
 - (C) Using DC standard sources and D'arsonval Galvanometer
 - (D) Using AC standard sources and transfer instruments
 - (E) Answer not known

178.



Calculate the value of R_X of a Kelvin's bridge having the values ratio of R_a to R_b is 1000Ω , R_1 is 5Ω and $R_1 = 0.5 R_2$.

- (A) 0.05Ω
- ~~(B) 0.01Ω~~
- (C) 0.03Ω
- (D) 0.001Ω
- (E) Answer not known

179. A Wheatstone bridge has ratio arms of 1000Ω and 100Ω resistance, the standard resistance Arms consists four decade resistance boxes of $1000, 100, 10, 1 \Omega$ steps. The maximum and minimum values of unknown resistance which can be determined with this set up is

- (A) $111100 \Omega, 1 \Omega$
- (B) $111000 \Omega, 1 \Omega$
- (C) $111100 \Omega, 10 \Omega$
- ~~(D) $11110 \Omega, 10 \Omega$~~
- (E) Answer not known

180. The factors which effects the precision of Wheatstone bridge are

- (A) Resistance of connecting leads
- (B) Thermo electric effect
- (C) Temperature effect
- ~~(D)~~ All the above
- (E) Answer not known

181. The PET uses positrons that react with electrons to emf two photons at _____ in opposite directions

- (A) 411 keV
- ~~(B)~~ 511 keV
- (C) 611 keV
- (D) 711 keV
- (E) Answer not known

182. _____ are used in computed Tomograph scan

- ~~(A)~~ X-Rays
- (B) Radio waves
- (C) Ultra sound
- (D) Infrared waves
- (E) Answer not known

183. An production of X-rays when the electro beam strikes the anode, if happens through two mechanisms _____ and _____

- (A) Characteristic radiation, roentgen radiation
- (B) Roentgen radiation, Bremsstrahlung
- (C) Linear radiation, roentgen radiation
- ~~(D)~~ Bremsstrahlung, characteristic radiation
- (E) Answer not known

184. In ERG, the ERP is _____ and LRP is _____ with light intensity
- (A) Linear, non-linear (B) Non-linear, linear
(C) Linear, linear (D) Non-linear, non-linear
(E) Answer not known
185. An ECG signal with a PR interval greater than 0.2 seconds is indicative of
- (A) Bradycardia (B) Arrhythmic
(C) Fast Heart Beat (D) Tachycardia
(E) Answer not known
186. Sources of bioelectric potential is _____ in nature
- (A) Electronic (B) Electric
 (C) Ionic (D) Radiation
(E) Answer not known
187. The resting potential of internal medium of human body is in the range
- (A) -40 to -90 mV (B) 40 to 90 mV
(C) 100 to 200 mV (D) -2 to -30 mV
(E) Answer not known
188. For determination of oxygen content of a gas, _____ is not an electrochemical method
- (A) Electrostatic stem method (B) Polarographic method
(C) Conductometric method (D) Galvanic method
(E) Answer not known

189. Chromatography is a physical method that is used to separate and analyse

- (A) Simple mixtures ~~(B) Complex mixtures~~
(C) Viscous mixtures (D) Metals
(E) Answer not known

190. _____ is not a source of error in spectrophotometric measurements

- ~~(A) Parallel error~~ (B) Stray light
(C) Electronic noise (D) Absorbance
(E) Answer not known

191. The most commonly used liquid mulling agent is

- ~~(A) Nujol~~ (B) Askeren
(C) Castor oil (D) NaCl
(E) Answer not known

192. _____ electrode is not used in pH measurements

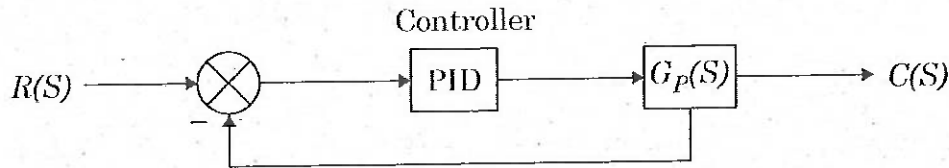
- (A) Hydrogen electrode (B) Glass electrode
(C) Calomel electrode ~~(D) Nano electrode~~
(E) Answer not known

193. Ion-Selective Electrode (ISE) has a precision level of _____ and can measure _____ ions

- (A) $\pm 15\%$, positive ions
(B) $\pm 3\%$, negative ions
~~(C) $\pm 3\%$, positive and negative ions~~
(D) $\pm 15\%$, positive and negative ions
(E) Answer not known

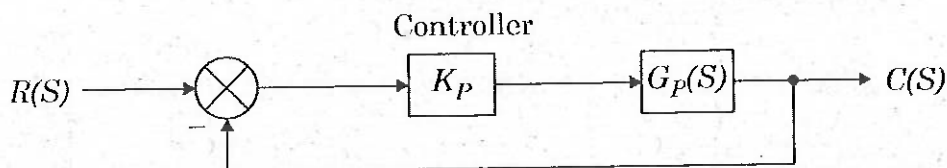
194. The primary function of the positioner in the control valve system is
- (A) to convert the electrical signal from the controller into a pneumatic signal
 - (B) to monitor the temperature of the fluid or gas
 - (C) to adjust the flow rate of the fluid or gas
 - ~~(D)~~ to provide feedback on the valve position to the controller
 - (E) Answer not known
195. The valve trims material best suited for applications with high-temperature fluids is
- (A) Stainless steel
 - (B) Brass
 - (C) Teflon
 - ~~(D)~~ Inconel
 - (E) Answer not known
196. The main objectives of Model predictive control are
(select two answers)
- I. Minimize the error between a reference trajectory and the measured future output
 - II. Minimize the error between the reference trajectory and predicted future output
 - III. Minimize the control action needed to drive the controlled variable to a setpoint range
 - IV. Maximize the cost of operation
- (A) I and II
 - ~~(B)~~ II and III
 - (C) III and IV
 - (D) I and III
 - (E) Answer not known

197. Figure shows a system having a transfer function $G_p(s) = \frac{1}{s(s+2)}$. A PID controller is used with following specifications. Derivative time constant = 0.5 sec. Integral time constant = 3 sec and proportional gain = 30. Find the steady state error for step input.



- (A) 2
~~(B) 0~~
 (C) 1
 (D) 0.5
 (E) Answer not known

198. For a closed loop system shown in figure, the transfer function is $G_p(s) = \frac{1}{s(s+4)}$ and the system is used with proportional control, the steady state error with a ramp input



- (A) K_p
 (B) $4K_p$
~~(C) $4/K_p$~~
 (D) 0
 (E) Answer not known

199. PID controllers are tuned on the frequency response of the closed-loop system by

- (A) Using the open-loop gain corresponding to marginal stability
- (B) Using the maximum amplitude of response
- (C) Using maximum value of phase
- (D) Using minimum value of phase
- (E) Answer not known

200. Choose the truthful statements from the following regarding model predictive control

- (i) It controls as many process variables as possible when sensor or actuator is not available
 - (ii) It has less computational cost for controller implementation
 - (iii) It has the ability to handle constraints on process inputs and outputs
 - (iv) It has high accuracy in determining the system model to obtain better closed loop performance
- (A) (i) only
 - (B) (i), (ii) and (iv)
 - (C) (ii) and (iii)
 - (D) (i), (iii) and (iv)
 - (E) Answer not known

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