Combined Engineering Services Exam

RECT

Booklet Series **A**

Register Number

2008

ELECTRICAL AND INSTRUMENTATION ENGINEERING

Time Allowed : 3 Hours] **[Maximum Marks : 300**

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

IMPORTANT INSTRUCTIONS

1. This Booklet has a cover (this page) which should not be opened till the invigilator gives signal to open it at the commencement of the examination. As soon as the signal is received you should tear the right side of the booklet cover carefully to open the booklet. Then proceed to answer the questions.
2. This Question Booklet contains **200** questions.
3. Answer **all** questions. **All** questions carry equal marks.
4. The Test Booklet is printed in *four* series *e.g.* [A] [B] [C] or [D] (See Top left side of this page). The candidate has to indicate in the space provided in the Answer Sheet the series of the booklet. For example, if the candidate gets [A] series booklet, he/she has to indicate in the side 2 of the Answer Sheet with Blue or Black Ink Ball point pen as follows :

   [A] [ ] [B] [C] [D]

5. 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.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. You must write your Name, Register No. and other particulars on side 1 of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.
7. You will also encode your Register Number, Subject Code etc., with Blue or Black Ink Ball point pen in the space provided on the side 2 of the Answer Sheet. If you do not encode properly or fail to encode the above information, your Answer Sheet will not be evaluated.
8. Each question comprises *four* responses (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet there are **four** brackets [A] [B] [C] and [D] against each question. To answer the questions you are to mark with Ball point pen ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. *e.g.* If for any item, (B) is the correct answer, you have to mark as follows :

   [A] [ ] [C] [D]

10. 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 Hall during the examination. After the examination is concluded, 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.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
12. Do not tick-mark or mark the answers in the Question Booklet.
13. The sheet before the last page of the Question Booklet can be used for Rough Work.

Tear here

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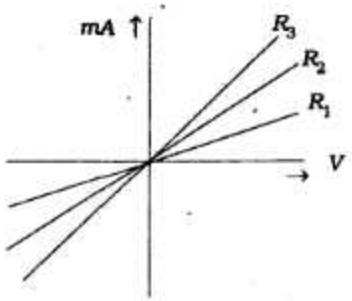
1. With the increase in temperature, the resistance of the pure metals
   A) increases B) decreases
   C) first increases and then decreases D) remains constant.
2. Which of the following statements is false in case of a series circuit ?
   A) The voltage drop across each resistor is the same
   B) The current flowing through each resistor is the same
   C) Applied voltage is equal to the sum of the voltage drops across individual resistors
   D) Resistors are additive.
3. Which of the following relations is not correct ?
   A) $P = \frac{V}{R^2}$ B) $P = VI$
   C) $I = \sqrt{\frac{P}{R}}$ D) $V = \sqrt{PR}$.
4. Two alternating quantities are added
   A) arithmetically B) graphically
   C) vectorially D) geometricaly.
5. All the rules and laws which apply to *dc* networks also apply to *ac* networks consisting of
   A) resistance only B) inductance only
   C) capacitance only D) all of these.
6. The resistor with least resistance is



   A) R_1
   B) R_2
   C) R_3
   D) all of these are with same resistance.

7. A capacitor

A) offers easy path to a.c. but blocks d.c.

B) offers easy path to d.c. but blocks a.c.

C) offers easy path to both a.c. and d.c.

D) blocks a.c.

8. A unit impulse function is obtained on the differentiation of

A) a unit ramp function B) a unit step function

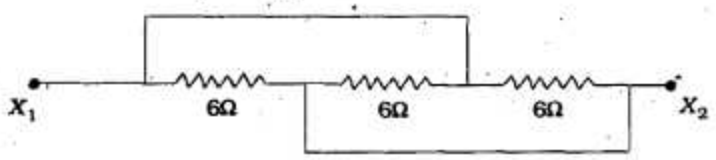
C) a unit triplet D) a unit doublet.

9. The equation for 25 cycles current sine wave having rms value of 30 amperes, will be

A) $30 \sin 25t$ B) $30 \sin 50t$

C) $42{\cdot}4 \sin 25\pi t$ D) $42{\cdot}4 \sin 50\pi t$.

10. Three resistances of 6Ω each are connected as shown in *fig.* The equivalent resistance between X_1 and X_2 is



A) 2Ω B) 4Ω

C) 8Ω D) 12Ω.

11. When a two-winding transformer is connected as an autotransformer, its efficiency (full-load)

A) remains same B) increases

C) decreases D) rises to 100%.

12. A Δ/Y transformer has a phase-to-phase voltage transformation ratio of a (delta phase) : 1 (star phase). The line-to-line voltage ratio Y/Δ is given by

A) $a/\sqrt{3}$ B) $a\sqrt{3}/1$

C) $\sqrt{3}/a$ D) a.

13. If the load on a *dc* shunt motor is increased, its speed decreases primarily due to

A) increase in its flux B) decrease in back emf

C) increase in armature current D) decrease in brush drop.

14. DC series motors are best suited for traction because

A) torque is proportional to the square of the armature current and speed is proportional to the torque.

B) torque is proportional to the square of the armature current and speed is inversely proportional to the torque.

C) torque and speed both are proportional to the square of the armature current.

D) none of these.

15. For a *d.c.* series motor with saturated condition of the field circuit, the torque developed is proportional to

A) I_a^2 B) I_a

C) speed D) voltage.

16. The damping winding in a synchronous motor is generally used to

A) prevent hunting and provide the starting torque

B) reduce eddy currents

C) minimise vibrations

D) reduce noise level.

17. In a synchronous generator operating at zero *pf* lagging, the effect of armature reaction is

A) magnetizing

B) demagnetizing

C) cross-magnetizing

D) both magnetizing and cross-magnetizing.

18. The disadvantage of starting an induction motor with a star-delta starter is that

A) the starting torque is one-third of the torque in case of delta connection

B) during starting high losses result

C) the starting torque increases and the motor runs with jerks

D) none of these.

19. The advantage of starting a slip-ring induction motor with the help of rotor resistance as compared to other methods is that the

A) starting torque increases due to rotor resistance

B) starting current is reduced

C) starter can be built directly into the rotor

D) none of these.

20. Electrical machines are designed to have maximum efficiency at

A) full-load B) 50% of full-load

C) near about full-load D) no-load.

21. The open loop transfer function of a unity feedback control system is given by

$$G(s) = \frac{k(s+2)}{s(s^2+2s+2)}$$

The centroid and angles of root locus asymptotes are respectively

A) zero and $+90^\circ, -90^\circ$ B) $-2/3$ and $+60^\circ, -60^\circ$

C) zero and $+120^\circ, -120^\circ$ D) $-2/3$ and -90° and $-90^\circ, +90^\circ$.

22. The characteristic equation of a closed loop system is given by

$$s^4 + 6s^3 + 11s^2 + 6s + k = 0.$$

Stable closed loop behaviour can be ensured when gain k is such that

A) $0 < k < 10$ B) $k > 10$

C) $-\infty \leq k < \infty$ D) $0 < k \leq 20$.

23. If the system has multiple pole on the $j\omega$-axis, it is

A) Stable B) Marginally stable

C) Unstable D) Conditionally stable.

24. The maximum phase shift that can be obtained by using a lead compensator with transfer function

$$Gc(s) = \frac{4(1+0{\cdot}15\,s)}{(1+0{\cdot}05\,s)}$$

is equal to

A) 15° B) 30°

C) 45° D) 60°.

25. A unity feedback control system has a forward path transfer function equal to

$$\frac{42{\cdot}25}{s(s+6{\cdot}5)}.$$

The unit step response of this system starting from rest will have its maximum value at a time equal to

A) 0 sec B) 0·56 sec

C) 5·6 sec D) infinity.

26. The impulse response of an *R-L* circuit is a

A) rising exponential function B) decaying exponential function

C) step function D) parabolic function.

27. A unity feedback second order control system is characterised by

$$G(s) = \frac{k}{s(js + B)}$$

where j = moment of inertia

k = system gain

B = viscous damping coefficient.

The transient response specification which is not affected by variation of system gain is the

A) peak overshoot B) rise time

C) setting time D) damped frequency of oscillations.

28. A system has the following transfer function :

$$G(s) = \frac{100(s+5)(s+50)}{s^4(s+10)(s^2+3s+10)}$$

The type and order of the system are respectively

A) 4 and 9 B) 4 and 7

C) 5 and 7 D) 7 and 5.

29. A value of a matrix in $\ddot{X} = A\dot{X}$ for the system described by the differential equation $\ddot{y} + 2\dot{y} + 3y = 0$ is

A) $\begin{bmatrix} 1 & 0 \\ -2 & -1 \end{bmatrix}$ B) $\begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix}$

C) $\begin{bmatrix} 0 & 1 \\ -2 & -1 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 0 \\ -3 & -2 \end{bmatrix}$

30. Consider the following statements regarding a linear system $y = f(x_2)$:

I. $f(x_1 + x_2) = f(x_2)$

II. $f[x(t+T)] = f[x(t)] + f[x(T)]$

III. $f(kx) = kf(x)$.

Of the statements :

A) I, II and III are correct B) I and II are correct

C) III alone is correct D) I and III are correct.

31. During load-shedding
    A) system voltage is reduced
    B) system frequency is reduced
    C) some loads are switched off
    D) system power factor is changed.

32. The half-life period of an isotope is 1 hr. 15/16 of it radiates out in
    A) 8 hrs
    B) 16 hrs
    C) 9 hrs
    D) 5 hrs.

33. When a fixed amount of power is to be transmitted, the efficiency of transmission increases when
    A) voltage decreases, power factor remains constant
    B) voltage increases, power factor increases
    C) voltage decreases, power factor decreases
    D) voltage constant, power factor decreases.

34. For a long uncompensated line the limit to the line loading is governed by
    A) thermal limit
    B) voltage drop
    C) stability limit
    D) corona loss.

35. With 100% series compensation of lines
    A) the circuit is series resonant at power frequency
    B) low transient voltage
    C) high transient current
    D) both (A) and (C).

36. The function of steel wire in an ACSR conductor is to
    A) take care of surges
    B) prevent corona
    C) reduce inductance and hence improve power factor
    D) provide additional mechanical strength.

37. Nominal-II model is normally used for evaluating the performance of
    A) short line
    B) medium line
    C) long line
    D) infinite line.

38. The inductance per unit length of an overhead line due to internal flux linkages
    A) depends on the size of the conductor
    B) is independent of the size of conductor and constant
    C) depends on the current through the conductor
    D) depends on distance between conductors.

39. The EHV system is one operating beyond

A) 11 kV B) 132 kV

C) 200 kV D) 400 kV.

40. As the height of transmission tower is increased, the line capacitance and the inductance respectively

A) decreases, remains unaltered B) decreases, decreases

C) increases, decreases D) increases, remains unaltered.

41. If the fault current is 2000 amps, the relay setting 50% and the C.T. ratio is 400/5 then the plug setting multiplier will be

A) 25 amps B) 15 amps

C) 50 amps D) none of these.

42. The fluids used in CBs should be of

A) high dielectric strength and thermal stability

B) non-inflammability

C) arc-extinguishing ability

D) all of these.

43. Which of the following circuit breakers has high reliability and negligible maintenance ?

A) Air blast B) SF_6

C) Oil D) Vacuum.

44. In the protection scheme, relay functions as

A) switching device B) sensing device

C) breaking device D) none of these.

45. Reactance relays are employed for phase fault in

A) short lines B) medium lines

C) long lines D) any of these.

46. Operation of fuse is based upon

A) photo-electric effect B) heating effect of electric current

C) magnetic effect of electric current D) none of these.

47. The actuating quantity for the relays may be

A) magnitude B) frequency

C) phase angle D) any of these.

48. In a static over-current relay, inverse time characteristics are obtained by

A) a transistor amplifier B) an integrating circuit

C) a transistor switch D) a differentiating circuit.

49. We do not require any protection against prime-mover failure in case of

A) turbo-generator sets B) hydro-generator sets

C) diesel engine driven alternators D) back pressure turbo-generators.

50. A material best suited for manufacturing fuse wire is

A) silver B) copper

C) aluminium D) zinc.

51. The phase comparator in a *PLL* circuit is used to provide

A) one-half the crystal oscillator frequency

B) RF output with audio modulation

C) DC control voltage

D) double crystal oscillator signal.

52. Avalanche breakdown is primarily dependent on the phenomenon of

A) collision B) doping

C) ionization D) recombination.

53. Ga, As, LEDS emit radiation in the

A) ultraviolet region

B) violet-blue green range of the visible region

C) visible region

D) infrared region.

54. Which of the following methods used for biasing a BJT in integrated circuits is considered independent of transistor beta ?

A) Fixed biasing B) Voltage divider biasing

C) Collector feedback biasing D) Base bias with collector feedback.

55. If two stages of a cascaded amplifier have decibel gains of 60 and 30, then overall gain is ..... dB.

A) 90 B) 1800

C) 2 D) 0·5.

56. In a common emitter amplifier, the unbypassed emitter resistor provides

A) voltage–shunt feedback B) current–series feedback

C) negative–voltage feedback D) positive–current feedback.

57. The depletion region of a semiconductor diode is due to

A) reverse biasing

B) forward biasing

C) crystal biasing

D) migration of mobile charge carriers.

58. A 741 OP-AMP has an open loop gain 200,000. The input offset voltage is 2 mV. If the input terminals are shorted, the output voltage is

A) 0V B) ∞

C) 400V D) $\pm$ 400V.

59. The maximum overall efficiency of a class-B push-pull amplifier cannot exceed ..... per cent.

A) 100 B) 78·5

C) 50 D) 85.

60. The following relationships between α and β are correct, *except*

A) $\beta = \frac{\alpha}{1-\alpha}$ B) $\alpha = \frac{\beta}{1-\beta}$

C) $\alpha = \frac{\beta}{1+\beta}$ D) $1 - \alpha = \frac{1}{1+\beta}$.

61. 2's complement of 10010010 is

A) 01101110 B) 00101110

C) 01001110 D) 01100010.

62. A multiplexer has

A) one input and one output B) one input and many outputs

C) many inputs and one output D) many inputs and many outputs.

63. A 4-bit synchronous counter uses flip-flops with propagation delay time of 15 ns each. The maximum possible time required for change of state will be

A) 15 ns B) 30 ns

C) 45 ns D) 60 ns.

64. Decimal number represented by the binary number 101101 is

A) $(43)_{10}$ B) $(45)_{10}$

C) $(47)_{10}$ D) $(49)_{10}$.

65. The minimal sum of products form of

$f = A\bar{B}CD + \bar{A}BC + \bar{A}\bar{B}C + BCD$ is

A) $A\bar{C} + BD$ B) $\bar{A}C + CD$

C) $AC + \bar{B}D$ D) $A\bar{B} + C\bar{D}$.

66. The minimum number of flip-flops needed to make mod-2 counter is

A) 1 B) 2

C) 3 D) 4.

67. Which one of the following is equivalent to AND-OR realization ?

A) NAND – NOR realization B) NOR – NOR realization

C) NOR – NAND realization D) NAND – NAND realization.

68. Which of the following identities is true ?

A) $A + BC = (\bar{A} + B)(\bar{A} + C)$ B) $A + BC = (\bar{A} + B)(A + C)$

C) $A + BC = (A + B)(\bar{A} + C)$ D) $A + BC = (A + B)(A + C)$.

69. Metastability in *D*-flip-flop occurs when

A) set-up time of input data is not met

B) clock period is too large

C) set and reset are active simultaneously

D) *D* and *Q* pins are shortened.

70. A *PLA* can be used

A) as a microprocessor B) as a dynamic memory

C) to realize a sequential logic D) to realize a combinational logic.

71. A driving point function can be expressed as $p(s)/q(s)$. The degrees of $p(s)$ and $q(s)$

A) should be same B) may differ by unity

C) may differ by zero or one D) are stable response.

72. A constant k low-pass filter has a cut-off frequency of 1000 Hz. At a frequency of 50 Hz, the phase shift is

A) 0 B) π

C) less than π D) more than π.

73. The poles of an RC function

A) are simple and lie on negative real axis

B) are simple and lie on the $j\omega$-axis

C) must be complex conjugate

D) may be anywhere on the s-plane.

74. When a number of 2-port networks are connected in cascade, the individual

A) Z_{OC} matrices are added B) V_{SC} matrices are added

C) chain matrices are multiplied D) H-matrices are multiplied.

75. The condition $AD - BC = 1$, for a two-port network implies that the network is

A) reciprocal network B) lumped element network

C) lossless network D) unilateral element network.

76. In a series resonance type BPF, $C = 1{\cdot}8$ PF, $L = 25$ mH, $R_F = 52\Omega$ and $R_L = 9$ kΩ. The resonance frequency will be

A) 751 Hz B) 751 kHz

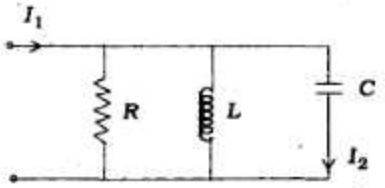
C) 751 MHz D) 826 MHz.

77. A unit impulse function is obtained on differentiation of a unit

A) ramp function B) step function

C) triplet D) doublet.

78. The driving point admittance function of the network shown in the figure has



A) poles at $s = 0$ and zero at $s = \infty$ B) poles at $s = 0$ and poles at $s = \infty$

C) poles at $s = \infty$ and zero at $s = 0$ D) poles at $s = \infty$ and zero at $s = \infty$.

79. According to the final value theorem

A) $F(0^-) = \lim_{s \to \infty} SF(s)$ B) $F(0^+) = \lim_{s \to \infty} SF(s)$

C) $F(\infty) = \lim_{s \to 0} SF(s)$ D) none of these.

80. The Z-parameters of a network are given by $\begin{bmatrix} 4 & 1 \\ 3 & 3 \end{bmatrix}$. Its transmission parameters will be

A) $\begin{bmatrix} 3 & 3 \\ 1 & 4 \end{bmatrix}$ B) $\begin{bmatrix} 4/3 & 3 \\ 1/3 & 1 \end{bmatrix}$

C) $\begin{bmatrix} 3 & 3 \\ 4 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 3 & 4/3 \\ 1 & 1/3 \end{bmatrix}$.

81. Bandwidth, a frequency domain concept, is inductive of

A) rise time in time domain B) settling time in time domain

C) steady state error in the domain D) all of these.

82. In an analog PMMC 0–10 A ammeter is provided with no controlling mechanisation and the moving parts are free to rotate. What will be the readings of the instrument if 1A (d.c.) is passed through the moving coil ?

(The torque produced is sufficient to overcome the frictional losses)

A) 1A

B) 10A

C) The pointer will continuously rotate

D) The pointer will remain stationary.

83. Permanent magnets are tested by

A) ballistic methods

B) using an electric circuit having a mutual inductance

C) potentiometric methods

D) Betteridge apparatus.

84. The voltage control circuits do not use resistance potential dividers because

A) they involve a large power loss

B) they cause distortion of waveform

C) they do not give a smooth variation of voltage

D) they have non-linear characteristics.

85. If an induction type energymeter runs fast, it can be slowed down by

A) lag adjustment

B) light load adjustment

C) by adjusting the position of braking magnet and making it come closer to the centre of the disc

D) by adjusting the position of braking magnet and making it move away from the centre of the disc.

86. The secondary winding of a C.T. is open when current is flowing in the primary. Then,

A) there will be a high current in primary

B) there will be a high voltage in secondary

C) the transformer will burn out immediately

D) the meter will burn out.

87. A potentiometer is basically a

A) deflectional type instrument

B) null type instrument

C) deflectional as well as null type instrument

D) a digital instrument.

88. The ratio of transformation in the case of potential transformers

A) increases with increase in power factor of secondary burden

B) remains constant irrespective of the power factor of secondary burden

C) decreases with increase in power factor of secondary burden

D) none of these.

89. Ballistic test is used in magnetic measurements for

A) determination of B-H curve of the specimen only

B) determination of hysteresis loop of the specimen only

C) determination of flux density, magnetizing force and B-H curve and hysteresis loop of the specimen

D) finding out iron losses in the specimen.

90. Which type of wattmeter cannot be used for D.C. ?

A) Electrostatic type
B) Dynamometer type
C) Induction type
D) None of these.

91. A DVM has a $4\frac{1}{2}$ digit display. The 1 volt range can read upto

A) 9999
B) 999
C) 1·9999
D) 0·19999.

92. The horizontal sweep speed is set so that a full cycle takes 0·4 m/sec. The resulting display for one sweep of beam will be

A) two cycles of the input signal
B) one cycle of the input signal
C) half cycle of the input signal
D) one-fourth cycle of the input signal.

93. A disc mounted on the shaft of a machine has 12 pattern points. The number of flashes projected on the disc by a stroboscope is 6000 in a minute. When the disc appears stationary and it has single image of 12 points, the speed of the machine will be

A) 5 rps
B) 50 rpm
C) 500 rpm
D) 50 rps.

94. A digital voltmeter measures

A) peak value
B) peak to peak value
C) rms value
D) average value.

95. Which of the following statements about CRO is correct ?

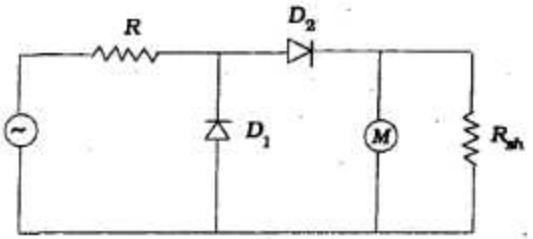
A) The lissajous pattern obtained in a CRO is used to measure distortion in the input signal.
B) The colour of the spot on the screen of a CRO is a characteristic of the electron gun in a CRT.
C) The time base signal in a CRO is a square waveform.
D) None of these.

96. A superheterodyne receiver with an IF of 450 kHz is tuned to a signal of 1200 kHz. The image frequency is

A) 750 kHz B) 1650 kHz

C) 2100 kHz D) None of these.

97. In the multimeter circuit shown in the figure for AC voltage measurement, the function of diode D_1 is to



A) provide half-wave rectification

B) make the rectifier D_2 perform full-wave rectification

C) by-pass reverse leakage current of D_2 in the negative cycle of the input

D) short-circuit over range voltages.

98. In a Q-meter, the value of shunt resistance connected across the oscillator is typically of the order of

A) Ω B) mΩ

C) μΩ D) kΩ.

99. A random noise generator produces a signal

A) whose amplitude varies randomly

B) which has no periodic frequency

C) has an unpredictable power spectrum

D) all of these.

100. An electronic voltmeter with a broad bandwidth has

A) low noise level and high sensitivity

B) high noise level and high sensitivity

C) high noise level and low sensitivity

D) low noise level and low sensitivity.

101. A resistance thermometer is an example of

A) zero order system B) first order system

C) second order system D) none of these.

102. The unit of static sensitivity is

A) millimetre per microampere B) millimetre per milliampere

C) micrometre per microampere D) micrometre per milliampere.

103. Random errors are otherwise known as

A) residual errors B) gross errors

C) threshold errors D) instrumental errors.

104. An undamped second order instrument has a natural frequency of 500 Hz. It is subjected to a sinusoidal input of unit amplitude at 500 Hz. The amplitude of output is

A) unity B) 0·5

C) 2·0 D) infinity.

105. A d.c. circuit can be represented by a voltage source of 10V in series with an output resistance of 1 kΩ. An ammeter of 50 Ω resistance is connected to the source terminals for measurement of current. The accuracy of measurement is nearly

A) – 4·8 per cent B) + 4·8 per cent

C) 99 per cent D) 95·2 per cent.

106. A first order thermometer has a time constant of 50s. It is subjected to sinusoidal input cycling at 0·002 Hz. The time lag of the instrument is

A) 50s B) 500s

C) 44·6s D) 0·01s.

107. A first order system has a time constant of 20s. It is subjected to a step input. The settling time of the output is assumed to be the time it reaches 95% of its final steady state value. The settling time of the system is

A) 100s B) 50s

C) 60s D) 20s.

108. The voltage of a circuit is measured by a voltmeter having an input impedance comparable with the output impedance of the circuit thereby causing error in voltage measurement. This error may be called

A) gross error

B) random error

C) error caused by misuse of instrument

D) error caused by loading effect.

109. The dead zone in a certain pyrometer is 0·125% of span. The calibration is 400°C to 1000°C. What temperature change might occur before it is deflected ?

A) 0·075°C B) 0·75°C

C) 7·5°C D) 1·5°C.

110. Changes in atmospheric temperature, humidity etc. cause

A) systematic errors B) instrumental errors

C) cumulative errors D) environmental errors.

111. A capacitive displacement transducer has plates of area 200 mm^2. The distance between plates is variable. The dielectric medium is air. The capacitor connected at the input end of the OP-AMP has a capacitance of 100 pF and voltage of 10V. $\varepsilon_0 = 8{\cdot}85 \times 10^{-12}$.

The sensitivity of the transducer will be

A) $0{\cdot}057 \times 10^6$ V/mm B) $0{\cdot}057 \times 10^3$ V/mm

C) 0·057 V/mm D) 0·057 mV/mm.

112. Three types of temperature transducers are compared as regards their sensitivity. The order in which they exhibit their sensitivities (highest to lowest) is

A) Thermistors, RTDs, thermocouples

B) Thermocouples, RTDs, thermistors

C) RTDs, thermistors, thermocouples

D) RTDs, thermocouples, thermistors.

113. Dunmore hygrometer has

A) linear resistance / relative humidity characteristics

B) non-linear resistance / relative humidity characteristics

C) linear inductance / relative humidity characteristics

D) non-linear inductance / relative humidity characteristics.

114. The microphones, which are widely used for sound measurement systems having a very wide range of amplitudes are

A) carbon microphones B) piezoelectric microphones

C) inductive microphones D) capacitive microphones.

115. A 100 Ω resistive potentiometer is used with an input supply voltage of 10V. If the thermal resistance 30°C/W and the ambient temperature is 40°C, the temperature of the POT is

A) 60°C B) 80°C

C) 70°C D) 100°C.

116. In wire-wound strain gauges, the change in resistance on application of strain is mainly due to

A) change in length of wire

B) change in diameter of wire

C) change in both length and diameter of wire

D) change in receptivity.

117. Piezoelectric transducers are

A) passive transducers B) active transducers

C) inverse transducers D) (B) and (C).

118. Piezoelectric accelerometer

A) should not be used for high frequencies above 100 Hz

B) should be used for low frequencies

C) should use a monitoring source of low input impedance

D) has a low natural frequency.

119. Capacitive transducers can be used for measurement of liquid level. The principal of operation used in this case is

A) change of capacitance with change of distance between plates

B) change of area of plates

C) change of dielectric strength

D) none of these.

120. A transducer has an output impedance of 1kΩ and the load resistance is 1MΩ. The transducer behaves as

A) a constant current source B) a constant voltage source

C) a constant power souree D) none of these.

121. A potentiometric type accelerometer can be used for measurement of vibration of frequencies

A) lower than 50 Hz
B) higher than 1 kHz
C) higher than 10 kHz
D) from 100 Hz and higher.

122. A toothed type tachogenerator has 60 teeth. A magnetic pick-up is used in conjunction with it. If the speed of the shaft to which the toothed wheel is connected is 25 rps, the number of pulses generated per second in the magnetic pick-up is

A) 3000
B) 1500
C) 1800
D) 1200.

123. A seismic transducer working in the displacement mode should be designed to have

A) weak springs and heavy mass
B) weak springs and light mass
C) stiff springs and heavy mass
D) stiff springs and light mass.

124. A vibrometer is an instrument, which can be used for measurement of vibrations by measuring

A) acceleration
B) displacement and velocity
C) displacement, velocity and acceleration
D) none of these.

125. Extremely small motion can be measured with

A) seismic type accelerometer
B) a pneumatic motion transducer
C) piezoelectric type transducer
D) an optical interferrometric type sensor.

126. The seismic transducers give satisfactory results, both in displacement mode and acceleration mode, if the damping factor is

A) 1
B) 0
C) nearly 0·7
D) nearly 0·5.

127. Elastic elements used for measurement of force give

A) high sensitivity and slow response
B) low sensitivity and fast response
C) low sensitivity and slow response
D) none of these.

128. Hoop stress acts

A) in radial direction
B) in axial direction
C) in both radial and axial directions
D) none of these.

129. When accelerometers operate in the displacement mode the ratio of forcing frequency to natural frequency should be

A) below 1
B) below 2
C) above 2
D) above 200.

130. Hydraulic load cells are available which have a maximum capacity of

A) 10 kN
B) 50 kN
C) 10 MN
D) 50 MN.

131. The size of a venturimeter is expressed as 200 × 100 mm. It means that

A) the diameter of the upstream pipe is 200 mm and that of downstream pipe 100 mm
B) the diameter of the pipe is 200 mm and that of throat is 100 mm
C) the diameter of the pipe is 100 mm and that of throat is 200 mm
D) none of these.

132. The accuracy of the dead weight testers is affected by

A) friction force between the piston and the cylinder
B) uncertainty of the value of the effective area of the piston
C) uncertainty of the value of gravitational constant
D) all of these.

133. Bridman gauges are used for measurement of

A) vacuum
B) medium pressures
C) high pressures
D) very high pressures.

134. The desirable property of a monometric fluid is

A) high viscosity
B) high coefficient of thermal expansion
C) low vapour pressure
D) corrosiveness and stickiness.

135. The discharge over a V-notch is proportional to

A) $H^{1.5}$ B) $H^{3.5}$

C) $H^{2.5}$ D) $H^{0.5}$.

136. Which of the following meters is used for measuring flow of clean fluids only ?

A) Ultrasonic flowmeter B) Hot wire anemometer

C) Turbine flowmeter D) All (A), (B) and (C).

137. In a vortex shedding flowmeter, the shedding freqtiency is $f = \frac{N_{st}\, V}{D}$ where N_{st} is

A) Reynolds number B) Mach number

C) Strouhal number D) none of these.

138. Mercury is used in liquid filled system as it gives

A) wide temperature range

B) high sensitivity

C) wide temperature range and approximately linear scale

D) wide temperature range and high sensitivity.

139. Semiconductor thermometers have the disadvantage that they

A) are not readily available and are expensive

B) are fragile and have low sensitivity

C) are large in size and have a poor frequently response

D) none of these.

140. In a balanced lever gauge, the movement of the lever arm is limited to

A) 180° B) 90°

C) 10° D) 5°.

141. In using capillary tube viscometer corrections are to be made for

A) change of density B) change in temperature

C) change in gravitational constant D) losses in head.

142. For an ideal Newtonian fluid, the relationship is

A) μ = shear stress / velocity gradient

B) μ = velocity gradient / shear stress

C) μ = velocity / stress

D) μ = stress / velocity.

143. Unit of density is

A) kg / m^3 B) g / m^3

C) kg / m^2 D) kg /m.

144. The rate of flow of fluid depends upon

A) density B) gravity force

C) viscosity D) all of these.

145. Which one of the following is not used for measurement of density ?

A) Manometer B) Hydrometer

C) Force balanced method D) Both (B) and (C).

146. The potential drop across pH meter is

A) $\Delta V_f = -2{\cdot}30 \frac{RT}{\xi} \log \frac{C_H}{C_R}$ B) $\Delta V_f = 2{\cdot}30 \frac{RT}{\xi} \log \frac{C_H}{C_R}$

C) $\Delta V_f = 2{\cdot}30 \frac{RT}{\xi} \log \frac{C_R}{C_H}$ D) $\Delta V_f = 1{\cdot}65 \frac{RT}{\xi} \log \frac{C_R}{C_H}$.

147. pH value of a solution is defined as

A) $pH = -\log_{10} (H^+)$ B) $pH = +\log_{10} (H^+)$

C) $pH = +\log_{10} (OH^-)$ D) $pH = -\log_{10} (OH^-)$.

148. The dissociation constant is the product of H^+ ions and OH^- ions and this product is always equal to

A) 10^{-16} B) 10^{-14}

C) 10^{-12} D) 10^{-15}.

149. A solution which has a pH value of more than 7 is

A) neutral in nature

B) acidic in nature

C) alkaline in nature

D) can be either acidic or alkaline in nature.

150. In a Saybolt viscometer, the viscosity can be measured to measuring the time to fill a flask with liquid volume equal to

A) 50 ml B) 200 ml

C) 60 ml D) 10 ml.

151. Which control action is best suited to control a flow process ?

A) P control action
B) $P + I$ control action
C) $P + D$ control action
D) $P + I + D$ control action.

152. A control configuration which has one manipulated variable and more than one measured variable is referred to as

A) cascade control
B) ratio control
C) inferential control
D) split range control.

153. Z-transform of a unit step function is

A) $\frac{1}{Z-1}$
B) $\frac{Z}{Z-1}$
C) $\frac{Z-1}{Z+1}$
D) $1/Z$.

154. The basic element for a pneumatic controller is

A) Op-Amp
B) RC circuit
C) Flapper nozzle
D) None of these.

155. Which of the following is not true for an Electronic Controller ?

A) It is compact
B) It is more accurate
C) It can operate an explosive atmosphere
D) All of these.

156. The differential gap is intentionally introduced in an ON/OFF controller to

A) reduce the life of final control element
B) increase the life of final control element
C) reduce the control action
D) none of these.

157. A control valve with positioner is referred to as

A) high gain proportional controller
B) low gain proportional controller
C) high gain integral controller
D) low gain integral controller.

158. Which of the following control actions is referred to as anticipatory control action ?

A) Integral control action

B) Proportional control action

C) Derivative control action

D) Proportional + Integral control action.

159. The main advantage of combining integral control action to proportional action is

A) short recovery time B) maximum overshoot

C) elimination of offset D) none of these.

160. Due to derivative control, the steady-state error is

A) ratio control reduced B) cascade control increased

C) split range control not effected D) inferential control made zero.

161. Blood flow can be measured using the electromagnetic principle because blood has a high

A) magnetic induction B) electrical resistivity

C) electrical conductivity D) impedance.

162. An ECG monitor usually has a frequency response of 0·05 Hz to about

A) 45 Hz B) 60 Hz

C) 70 Hz D) 100 Hz.

163. A cardioverter is a defibrillator that is synchronized to discharge only on the patient's

A) *T*-wave B) *R*-wave

C) *P*-wave D) *Q*-wave.

164. Polarised cell resting potential is about

A) – 90 mV B) + 90 mV

C) – 45 mV D) + 20 mV.

165. Loudspeaker is also used in the recorder of

A) EMG B) ECG

C) EOG D) EEG.

166. The use of notch filter in signal conditioning system is to

A) filter R.F. noise

B) filter 50 Hz noise from mains

C) filter the signal from various noises

D) attenuate the evolved response potentials.

167. In the case of ERG, what type of electrodes are used to pick-up signals ?

A) Disc electrodes B) Retinal electrodes

C) Vacuum type electrodes D) pH electrodes.

168. The active transducer in the measurement of pressure is

A) piezoelectric transducer B) capacitive transducer

C) strain gauge D) inductive transducer.

169. Arrhythmia can be diagnosed by

A) EEG B) ECG

C) Vector cardiogram D) Phono-cardiography.

170. In the case of defibrillator, a double square pulse type is used to

A) restart the heart rhythm after the open heart surgery

B) arrest ventricular fibrillation

C) arrest leakage of blood from the heart

D) arrest the reverse flow of blood from ventricule to atrium.

171. The beam width between first-null of uniform linear array of N equally spaced (element spacing = d) equally excited antennas is determined by

A) N alone and not by d B) d alone and not by N

C) the ratio (N/d) D) the product (Nd).

172. The Nyquist sampling rate for the signal $g(t) = 10 \cos(50 \pi t) \cos^2(150 \pi t)$ where t is in seconds, is

A) 150 samples per second B) 200 samples per second

C) 300 samples per second D) 350 samples per second.

173. Two carriers 40 MHz and 80 MHz respectively are frequency modulated by a signal of frequency 4 kHz, such that the bandwidths of the FM signal in the two cases are the same. The peak deviation in the two cases are in the ratio of

A) 1 : 4 B) 1 : 2

C) 1 : 1 D) 2 : 1.

174. Medium wave radio signals may be received at far off distances at night because

A) radio waves travel faster at night

B) ground wave attenuation is low at night

C) the sky wave is stronger at night

D) there is no fading at night.

175. For transmission of normal speech signal, the PCM channel needs a bandwidth of

A) 64 kHz B) 8 kHz

C) 4 kHz D) 2 kHz.

176. A comparison of frequency division and time division multiplexing systems shows that

A) FDM requires a lower bandwidth, but TDM has greater noise immunity

B) FDM has greater noise immunity and requires lower bandwidth than TDM

C) FDM requires channel synchronisation, while TDM has greater noise immunity

D) FDM requires more multiplexing, while TDM requires band-pass filter.

177. A communication channel disturbed by additive white Gaussian noise has a bandwidth of 4 kHz and SNR of 15. The highest transmission rate that such a channel can support (in k-bits / sec) is

A) 16 B) 1·6

C) 32 D) 60.

178. The intermediate frequency of a superhet receiver is 450 kHz. If it is tuned to 1200 kHz, the image frequency will be

A) 750 kHz B) 900 kHz

C) 1650 kHz D) 2100 kHz.

179. Source encoding in a data communication system is done in order to

A) enhance the information transmission rate

B) increase the transmission errors

C) conserve the transmitted power

D) facilitate clock recovery in the receiver.

180. The root locus always starts as

A) open loop poles B) open loop zeros

C) closed loop poles D) closed loop zeros.

181. The interface chip used for data transmission between 8086 and a 16 bit ADC is

A) 8259 B) 8255

C) 8253 D) 8251.

182. The TRAP is one of the interrupts available in INTEL 8085. Which one of the following statements is true of TRAP ?

A) It is level triggered

B) It is negative edge triggered

C) It is positive edge triggered

D) It is both positive edge triggered and level triggered.

183. In 8085 microprocessor system, the direct addressing instructions is

A) Mov *A, B* B) Mov *B, OAH*

C) Mov *C, M* D) STA adds.

184. A ROM is used to store the table for multiplication of two 8-bit unsigned integers. The size of ROM required is

A) 256 k × 16 B) 64 k × 8

C) 4 k × 16 D) 64 k × 16.

185. The following program is run on an 8085 Microprocessor :

Memory address in hex	*Instruction*
2000	LXISP, 1000
2003	PUSH H
2004	PUSH D
2005	CALL 2050
2008	POPH
2009	HLT

At the completion of execution of the program, the program counter of the 8085 contains ..... and the stack pointer contains ..... .

A) 2050, OFFC B) 2020, OCCF

C) 2000, CCFO D) 2020, OFFC.

186. In a generic microprocessor, instruction cycle time is

A) shorter than machine cycle time

B) larger than machine cycle time

C) exactly double the machine cycle time

D) exactly the same as the machine cycle time.

187. The stack pointer in the 8085 microprocessor is a

A) 16 bit register that points to stack memory locations

B) 16 bit accumulator

C) memory location in the stack

D) flag register used for the stack.

188. Match **List I** (Request) correctly with **List II** (Device) and select your answer using the codes given below :

List I	**List II**
a) Interrupt	1. I/O device
b) Wait	2. DMA controller
c) Hold	3. Memory

Codes :

	a	*b*	*c*
A)	1	2	3
B)	1	3	2
C)	2	1	3
D)	2	3	1.

189. An 'Assembler' for a microprocessor is used for

A) assembly of processors in a production line

B) creation of new programmes using different modules

C) translation of a program from assembly language to machine language

D) translation of a higher level language into English text.

190. In a multiprocessor configuration, two coprocessors are connected to the host 8086 processor. The two coprocessor instruction sets

A) must be the same

B) may overlap

C) must be disjoint

D) must be the same as that of the host.

191. In DC8 the available method for security design approach is

A) manual back-up approach

B) hot stand-by redundancy approach

C) multiple active redundant controller

D) all of these.

192. Which one of the following methods is not a network topology ?

A) Star B) Token-passing

C) Ring D) Mesh.

193. Which one of the following is not an operator display device ?

A) Menu B) Indicator

C) Alarm D) Screen area.

194. What size computers are used for supervisory control application ?

A) Mainframe computer B) Minicomputer

C) Microcomputer D) None of these.

195. A supervisory control has been applied in chemical process to

A) minimize operating cost

B) maximize efficiency in raw material utilization

C) maximize production profit

D) all of these.

196. Hand held programmers are used for programming

A) small PLCs B) medium PLCs

C) large PLCs D) none of these.

197. Which of the following is not true for a counter instruction in PLC ?

A) Up-counters are always reset to zero

B) The counter will operate on the trailing edge

C) A separate coil is used for reset

D) All of these.

198. Normally PUT instruction is programmed in which part of the logic rung in a PLC program ?

A) Input B) Output

C) Either input or output D) None of these.

199. Identify the part of the distributed control system.

A) High level computing device B) Low level human interface

C) Data Input / Output unit D) All of these.

200. The protocol which is not a media access protocol, is

A) Command / Response B) Token passing

C) CRC D) QMA / CD.

(SPACE FOR ROUGH WORK)

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