1. According to Kalman's test for observability, a linear time-invariant system with an $n \times n$ state matrix A and an output matrix C is completely observable if and only if the observability matrix

$V = \begin{bmatrix} C \\ CA \\ \vdots \\ CA^{n-1} \end{bmatrix}$ satisfies which of the following mathematical conditions?

(A) Determinant of V is equal to n

(B) Rank of V is equal to n

(C) Trace of V is equal to n

(D) Null of V is equal to n

(E) Answer not known

2. Match the physical descriptions regarding state-to-output behaviors with their precise observability definitions.

State-output interaction	Observability property
(a) Every state variable affects some or all of the system outputs over time	1. Unobservable system
(b) Atleast one state variable is completely decoupled and never affects the output	2. Completely observable system
(c) The output matrix is defined as a fixed identity matrix	3. Trivial observation

	(a)	(b)	(c)
(A)	1	2	3
(B)	2	1	3
(C)	3	1	2
(D)	2	3	1

(E) Answer not known

3. When transforming a linear time-invariant system (A, B, C) into its Observable Canonical Form (OCF). Identify the correct operational sequence of steps to find the final coefficient matrices.

1. Construct the upper-triangular Toeplitz matrix W using the polynomial coefficients.
2. Determine the characteristic equation coefficients from det (SI – A) = 0
3. Compute the OCF system matrices using $A_0 = P^{-1}AP, B_0 = P^{-1}B$ and $C_0 = CP$
4. Evaluate the similarity transformation matrix P using the relation $P = (WQ_0)^{-1}$.
5. Build the system's observability matrix Q_0 from the matrix pair (A, C)

(A) $2 \rightarrow 5 \rightarrow 1 \rightarrow 4 \rightarrow 3$

(B) $5 \rightarrow 2 \rightarrow 4 \rightarrow 1 \rightarrow 3$

(C) $2 \rightarrow 1 \rightarrow 5 \rightarrow 3 \rightarrow 4$

(D) $5 \rightarrow 1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

(E) Answer not known

4. Let A be an n × n square matrix, and λ be a scalar. Choose the following true statements regarding the eigenvalues of matrix A?

(A) Eigenvalues are the roots of the characteristic equation $|A - \lambda I| = 0$

(B) Eigenvalues are the non-zero solutions to the linear system $AX = 0$

(C) Eigenvalues are always equal to the diagonal elements of matrix A

(D) Eigenvalues are the vectors that satisfy the equation $Ax = \lambda x$

(E) Answer not known

5. In root locus plot, the point at which asymptotes cross the real axis is known as

(A) Centroid

(B) Angle of arrival

(C) Angle of departure

(D) Break-away point

(E) Answer not known

6. Arrange the following root locus construction steps in correct order.

1. Determine the root locus on real axis.
2. Find breakaway and break in points.
3. Locate the poles and zeros on S-plane.
4. Determine the asymptotes of root locus branches and meeting point of asymptotes with real axis.
5. Find the points where the root locus may cross the imaginary axis

(A) 5, 4, 3, 2, 1

(B) 3, 1, 4, 2, 5

(C) 2, 3, 1, 4, 5

(D) 1, 2, 4, 5, 3

(E) Answer not known

7. Which of the following statements are true about Bode plot?

(i) Gain crossover, phase crossover, gain margin and phase margin are more easily determined on bode plot than from the Nyquist plot.

(ii) In the absence of a computer, a Bode diagram can be sketched by approximating the magnitude and phase with straight-line segments.

(iii) Absolute and relative stability of only non minimum phase systems can be determined from the Bode plot.

(A) (i) only
(B) (ii) only
(C) (i) and (ii) only
(D) (i) and (iii) only
(E) Answer not known

8. Determine the range of 'A' for stability of an unity feedback system whose open loop transfer function is $G(s) = \frac{A}{s(s+1)(s+2)}$.

(A) $0 < A < 12$
(B) $0 < A < 9$
(C) $0 < A < 6$
(D) $0 < A < 18$
(E) Answer not known

9. Make a Routh array and identify how many roots of the following polynomial are in the right half of S-plane.

$P(s) = 3s^7 + 9s^6 + 6s^5 + 4s^4 + 7s^3 + 8s^2 + 2s + 6$

(A) Three roots
(B) Seven roots
(C) Four roots
(D) Five roots
(E) Answer not known

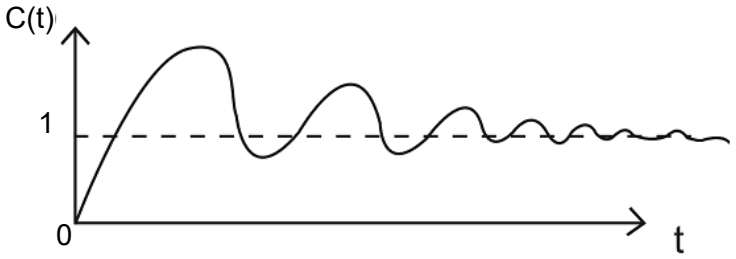
10. A unity negative feedback system has an open loop transfer function $G(s) = \frac{K}{s(s+10)}$. The gain K for the system to have a damping ratio of 0.25 is _____.

(A) 4 (B) 20

(C) 400 (D) 100

(E) Answer not known

11. Time domain response of a second order control system for unit step input is shown in Figure. Identify the type of damping present in the response



(A) Over damping (B) Critical damping

(C) No damping (D) Under damping

(E) Answer not known

12. Determine type and order of the system whose transfer function is given below

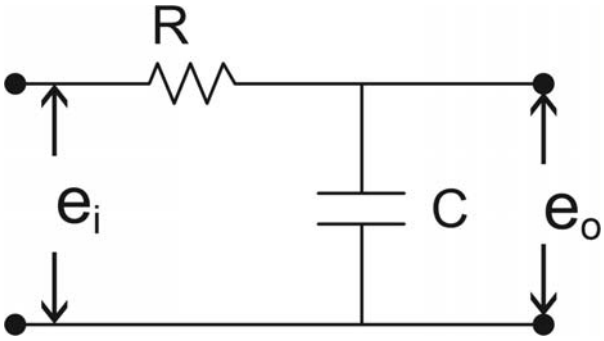
$$G(s)\,H(s) = \frac{20(s+2)}{s^2(s+3)(s+0.5)}$$

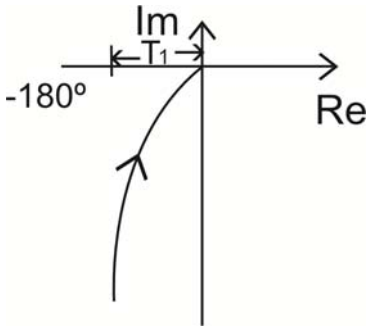
(A) type-1, order-3 (B) type-1, order-2

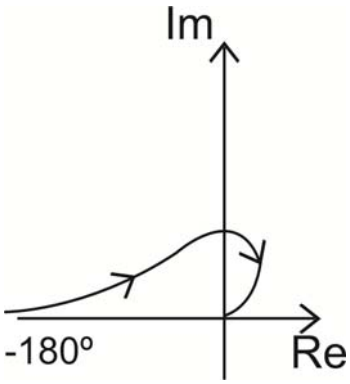
(C) type-3, order-4 (D) type-2, order-4

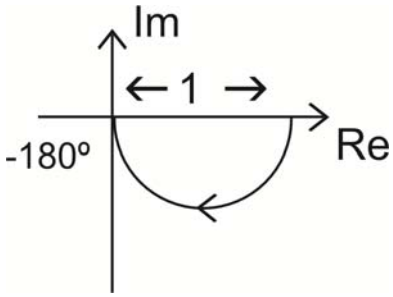
(E) Answer not known

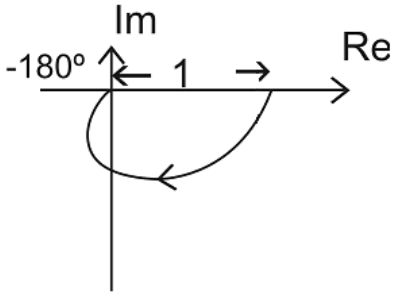
13. The approximate polar plot of the RC filter network shown in figure is



(A) 

(B) 

(C) 

(D) 

(E) Answer not known

14. Which of the following statements are true about stability of control systems?

(i) Absolute stability indicates whether the system is stable or not

(ii) Relative stability indicates how stable the system is

(iii) Absolute stability cannot be checked by Routh-Hurwitz criterion

(iv) Time domain analysis uses gain margin to find relative stability

(A) (i) only

(B) (i) and (ii) only

(C) (iii) only

(D) (i), (ii) and (iv) only

(E) Answer not known

15. Assertion [A] : Introducing negative feedback into a control system reduces the overall system gain while enhancing its absolute stability.

Reason [R] : The closed-loop transfer function denominator for a negative feedback system is expressed as $(1+G(s)\,H(s))$, which scales down the forward path gain by a factor of $(1+G(s)\,H(s))$.

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

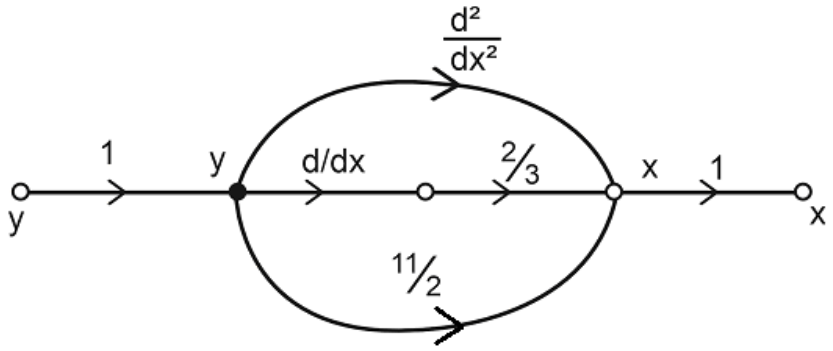
(B) Both [A] and [R] are true, but [R] is not the correct explanation of [A]

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

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

(E) Answer not known

16. A signal flow graph of a system given below has an input y and an output x.



Which of the following differential equations correctly represents this system?

(A) $\frac{d^2y}{dx^2}+\frac{2}{3}\frac{dy}{dx}-\frac{11}{2}y=0$

(B) $y\frac{d^2y}{dx^2}-\frac{2}{3}\frac{dy}{dx}-\frac{11}{2}y=0$

(C) $y\frac{d^2y}{dx^2}-\frac{2}{3}\frac{dy}{dx}-\frac{11}{2}y=x$

(D) $\frac{d^2y}{dx^2}+\frac{2}{3}\frac{dy}{dx}+\frac{11}{2}y=x$

(E) Answer not known

17. In system analysis using a Signal Flow Graph (SFG), identity the condition required to classify two or more loops as non-touching?

(A) They share atleast one common branch

(B) They do not share any common nodes

(C) They share the same input and output nodes

(D) They travel in opposite direction

(E) Answer not known

18. Identify the components of feedback control system

(a) Open Loop system (plant)

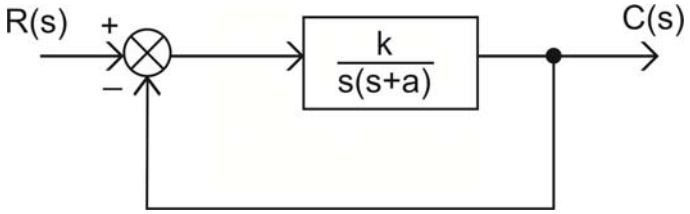
(b) Feedback path elements

(c) Error detector

(d) Controller

(A) (a), (b), (c) and (d)
(B) (a) and (b) only
(C) (a) and (c) only
(D) (a), (b) and (c) only
(E) Answer not known

19. Find the closed loop transfer function of the given second order feedback control system



(A) $T(s) = k/s^2 + as + k$
(B) $T(s) = k/s^2 + a$
(C) $T(s) = k/s^2 + k$
(D) $T(s) = k/s^2 + a + k$
(E) Answer not known

20. Find the transfer function represented by $\frac{dc(t)}{dt} + 2c(t) = r(t)$

(A) $G(s) = \frac{1}{s-1}$
(B) $G(s) = \frac{1}{s-2}$
(C) $G(s) = \frac{1}{s+1}$
(D) $G(s) = \frac{1}{s+2}$
(E) Answer not known

21. In wired network, the time interval in which frames can overlap is called

(A) Contention period
(B) Continuous time
(C) Channel throughput
(D) Channel load
(E) Answer not known

22. The data link layer divides the stream of bits received from the network layer into data units called as

(A) Segments
(B) Frames
(C) Datagrams
(D) Messages
(E) Answer not known

23. When data are transmitted from device A to device B, the header from A's layer 5 is read by B's _____ layer.

(A) Physical
(B) Session
(C) Transport
(D) Presentation
(E) Answer not known

24. The TDM can manage various source of

(A) Frequency division
(B) Bandwidth
(C) Wavelength
(D) Data rates
(E) Answer not known

25. The good performance of the envelop detector is attained under the condition

(A) $\frac{1}{f_c} << R_c << \frac{1}{W}$

(B) $\frac{1}{f_c} >> R_c >> \frac{1}{W}$

(C) $f_c << R_c << \frac{1}{2W}$

(D) $\frac{1}{f_c} << R_c$ and $R_c >> \frac{1}{W}$

(E) Answer not known

26. For Chebyshev Type – I filters, as the ripple factor $\varepsilon \to 0$, then the filter approaches :

(A) Low Pass Filter

(B) Chebyshev Type-II Filter

(C) High Pass Filter

(D) Butterworth Filter

(E) Answer not known

27. Which of the following is an advantage of bilinear transformation over impulse invariance?

(A) Easier Computation

(B) No Frequency Warping

(C) Preserves magnitude response exactly

(D) Prevents aliasing

(E) Answer not known

28. The second order system function of normalized Butterworth filter is

(A) $\left(\frac{1}{s^2+\sqrt{2}s+1}\right)$ (B) $1/s^2+2s+1$

(C) $1/(s+1)$ (D) $1/s^2+s+1$

(E) Answer not known

29. An FIR filter has length N = 23. Its group delay equals

(A) 12 (B) 22

(C) 11 (D) 24

(E) Answer not known

30. For a real sequence $x(n)$, $X(2)=3+j4$ for an 8-point DFT. Then $X(6)$ equals to _____.

(A) $3+j4$ (B) $-3+j4$

(C) $-3-j4$ (D) $3-j4$

(E) Answer not known

31. The speed improvements factor for complex multiplication in FFT algorithm is if N = 256,

(A) 113.8 (B) 64

(C) 31.87 (D) 8.0

(E) Answer not known

32. In ARM processors, the SWI instruction is used to

(A) Switch the processor to supervisor mode to execute OS and handle exceptions

(B) Switch the processor to user mode for normal programme execution

(C) Enter into undefined mode for illegal instruction detection

(D) Trigger fast interrupt handling for high speed external devices

(E) Answer not known

33. A stable analog LTI system with transfer function $H_a(s)$ has all its poles strictly in the left-half of S-plane. This system is converted into a discrete time system $H(z)$ using the Impulse invariance method with sampling period $T > 0$. Which of the following statement is true?

(A) The resulting digital system is stable because poles map inside the unit circle

(B) The resulting digital system is marginally stable regardless of pole locations

(C) The resulting digital system is unstable due to aliasing

(D) Stability depends on frequency warping introduced by the transformation

(E) Answer not known

34. The program counter in PIC micro controller is used to

(A) Control ports

(B) Store ALU result

(C) Point to next instruction

(D) Store data

(E) Answer not known

35. PIC microcontroller falls under _____ architecture.

(A) RISC
(B) MISC
(C) CISC
(D) SISC
(E) Answer not known

36. A standard 8051 microcontroller provides 32 programmable I/O lines with each I/O port being same bits wide. The number of I/O ports available in the microcontroller is

(A) 3 ports
(B) 4 ports
(C) 8 ports
(D) 32 ports
(E) Answer not known

37. The level triggering interrupts of 8085 CPU are

(A) RST 6.5 and RST 5.5
(B) RST 7.5 and RST 6.5
(C) RST 5.5 and RST 7.5
(D) INTR and TRAP
(E) Answer not known

38. The number of clock cycles required to execute NOP operation in 8086 is

(A) 1
(B) 2
(C) 3
(D) 4
(E) Answer not known

39. The 8086 microprocessor has

(A) 20 Address lines and 16 data lines

(B) 16 Address lines and 20 data lines

(C) 16 Address lines and 16 data lines

(D) 20 Address lines and 20 data lines

(E) Answer not known

40. Which of the following is the vector address of the non-maskable and highest priority interrupt in 8085?

(A) 0 0 3 C H

(B) 0 0 3 4 H

(C) 0 0 2 4 H

(D) 0 0 2 C H

(E) Answer not known

41. A DAC has 6 bits and a reference voltage of 10 V. Calculate the minimum value of R such that the maximum value of output does not exceed 10 mA. (approximate value of R)

(A) 2 kΩ

(B) 4 kΩ

(C) 3 kΩ

(D) 1 kΩ

(E) Answer not known

42. Low frequency Signals (400 Hz – 70 KHz) cannot be directly transmitted via radio primarily because:

(A) they require impractically large antenna

(B) they are too noisy

(C) they cannot be multiplexed

(D) they violate Nyquist theorem

(E) Answer not known

43. A temperature controller has a proportional band of 5% and a set-point of 500°F. The proportional band in degree Fahrenheit is:

(A) 50°F
(B) 25°F
(C) 100°F
(D) 5°F
(E) Answer not known

44. In a PLC rung, three Normally Open (NO) contacts are connected in series, controlling an output coil. If one contact fails in the closed state, the output will:

(A) Always be OFF
(B) Always be ON
(C) Oscillate
(D) Depend on other inputs
(E) Answer not known

45. For a 5-bit resistive divider, determine the output voltage for a digital input of 10111. (Assume 0 = 0 V and 1 = +10 V)

(A) 7.18 V
(B) 7.42 V
(C) 9.35 V
(D) 8.42 V
(E) Answer not known

46. Which recording method is most suitable for instrumentation tape recorders when handling very low frequencies down to DC?

(A) Direct recording
(B) Frequency modulation recording
(C) Pulse amplitude modulation recording
(D) High bias audio recording
(E) Answer not known

47. In an electromagnetic type flow meter :

Assertion [A] : AC excitation of electromagnet is done to produce AC emf.

Reason [R] : AC emf can be easily amplified compared to DC.

(A) Both [A] and [R] are correct, [R] is the correct explanation for [A]

(B) Both [A] and [R] are correct, [R] is not the correct explanation for [A]

(C) Both [A] and [R] are not correct

(D) [A] is correct, [R] is not correct

(E) Answer not known

48. A resistance wire strain gauge uses a soft iron wire of a small diameter. The gauge factor is +4.0. Neglecting the piezoresistive effects, calculate the Poisson's ratio.

(A) 3 (B) 5

(C) 1.5 (D) 2.5

(E) Answer not known

49. In an industrial furnace, an operator notes that the metal inside a kiln has shifted in colour from Dark Red to a vibrant orange colour. What is the estimated change in temperature of the metal?

(A) It has cooled to 400°C from 800°C

(B) It has cooled to 800°C from 1200°C

(C) It has heated up from 600°C to 1200°C

(D) It has heated up from 600°C to 900°C

(E) Answer not known

50. The switching time of an LED is in the order of

(A) 1s – 10s
(B) 1ms – 10ms
(C) $1\,\mu$s – $100\,\mu$s
(D) 1ns – 10ns
(E) Answer not known

51. Why is Maxwell's inductance capacitance bridge restricted to measure coils with Q between 1 and 10.

1. The bridge requires high supply frequency to balance high Q coils, which burn out the circuit
2. Achieving a balance requires a very high variable resistor
3. It requires a variable inductor rather than a capacitor, and variable inductors inherently possess poor Q factor
4. The balance equation becomes entirely frequency dependent when Q factor exceeds 10

(A) 1
(B) 2
(C) 3
(D) 4
(E) Answer not known

52. Wein Bridge is widely used in electrical instrumentation. Which of the following identifies its application and characteristics?

1. Measurement of ultra high inductance; balance equations are independent of frequency.
2. Measurement of dielectric loss in high voltage capacitors; balance requires a variable standard inductor.
3. Measurement of audio frequencies; balance equations are highly dependent on source frequency.
4. Measurement of low resistance, balance eliminates lead and contact resistance errors.

(A) 1 (B) 2
(C) 3 (D) 4
(E) Answer not known

53. What is the fundamental operating principle of a bolometer?

(A) Photoelectric effect where incident photons release free electrons
(B) Piezoelectric effect where mechanical pressure generates voltage
(C) Change in resistance due to heating by incident radiation
(D) Thermoelectric voltage generation across 2 dissimilar junctions
(E) Answer not known

54. Which of the following bridge is used to measure the di-electric loss of a given component?

(A) Hay's Bridge

(B) Maxwell's Inductance Capacitance Bridge

(C) Owen's Bridge

(D) Schering Bridge

(E) Answer not known

55. In the Oscilloscope during the retrace time, the electrons forming the horizontal beam will be

(A) Move from top to bottom of the screen

(B) Move from left to right on the screen

(C) Move from right to left on the screen

(D) Move bottom to top of the screen

(E) Answer not known

56. Find the value of multiplier resistance on the 50 V range of a dc voltmeter that uses a 500 μA meter movement with an internal resistance of 1 kΩ

(A) 99 kΩ (B) 100 kΩ

(C) 01 kΩ (D) 101 kΩ

(E) Answer not known

57. A meter Reads 127.50 V and the true value of the voltage is 127.43 V. The static error for this instrument is

(A) +0.07 V (B) –0.07 V

(C) +0.7 V (D) –0.7 V

(E) Answer not known

58. A permanent magnet moving coil instrument has a coil of dimension 15 mm × 12 mm. The flux density in the air gap is 1.8×10^{-3} wb/m^2 and the spring constant is 0.14×10^{-6} Nm/rad. Determine the number of turns required to produce an angular deflection of 90° when a current of 5 mA is flowing through the coil.

(A) 55
(B) 104
(C) 136
(D) 440
(E) Answer not known

59. A circular piece of specimen has a surface resistance R_s. Its diameter is d and the thickness is t. The surface resistivity (ρ_s) of the specimen is given by

(A) $\left(\pi d^2 R_s\right)/t$
(B) $(\pi d R_s)/t$
(C) $(R_s t)/\pi d^2$
(D) $(R_s t)/\pi d$
(E) Answer not known

60. A watt meter has a full scale range of 2500 W. It has an error ±1% of true value. What would be the range of reading if true power is 1250 W?

(A) 1225 W – 1275 W
(B) 1245 W – 1255 W
(C) 1200 W – 1300 W
(D) 1237.5 W – 1262.5 W
(E) Answer not known

61. In ROM, the programming is done by applying a _____ to each output terminal where a logic 1 must be stored.

(A) Current pulse
(B) Voltage
(C) Power pulse
(D) Spike
(E) Answer not known

62. If a digital unit has several data input lines and a single output line, it is called as

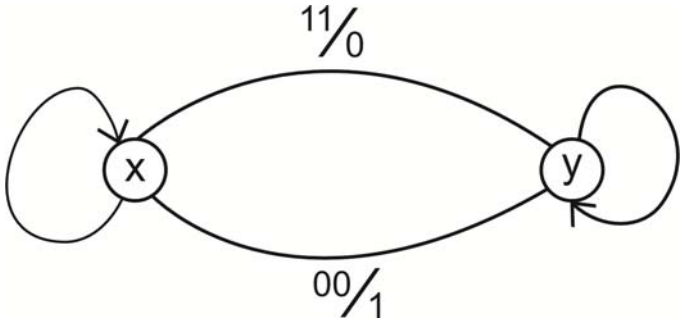
(A) Multiplier
(B) Multiplexer
(C) Sequential circuit
(D) Decoder
(E) Answer not known

63. The characteristic table shown below is for

X	Q(t + 1)	
0	Q(t)	No change
1	Q'(t)	Complement

(A) RS flipflop
(B) JK flipflop
(C) D flipflop
(D) T flipflop
(E) Answer not known

64. What does the following state diagram represent?

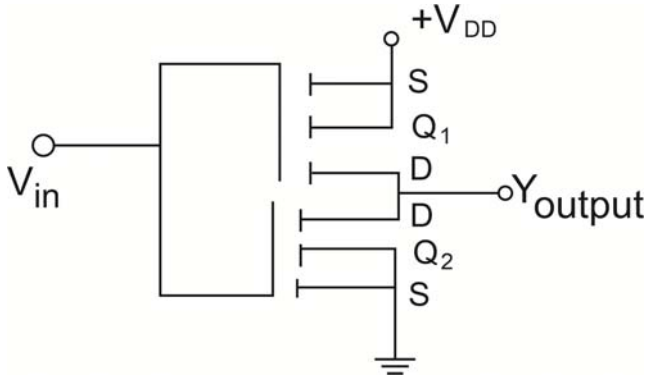


(A) Parallel sequence detector
(B) Serial sequence detector
(C) Serial binary adder
(D) Parallel binary adder
(E) Answer not known

65. The presence of Diode D_1 at the input in a TTL inverter is for

(A) Half wave rectification
(B) Protection
(C) Grounding Vcc
(D) Decreasing output voltage
(E) Answer not known

66. What does the following figure represent?



(A) CMOS Inverter
(B) MOS attenuator
(C) CMOS attenuator
(D) CMOS transistor
(E) Answer not known

67. The propagation delay of Diode-Transistor Logic is

(A) 25 s
(B) 25 ns
(C) 20 ms
(D) 18 s
(E) Answer not known

68. Complement the expression

$\overline{A}B + C\overline{D}$

(A) $\overline{A}\,\overline{B} + \overline{C}\,\overline{D}$ (B) $AB \cdot CD$

(C) $\left(A + \overline{B}\right) \cdot \left(\overline{C} + D\right)$ (D) $\left(\overline{A} + \overline{B}\right) \cdot \left(\overline{C} + D\right)$

(E) Answer not known

69. The signal fixed point number in floating point representation of a number is called

(A) access (B) mantissa

(C) divident (D) binary

(E) Answer not known

70. A string of four bits is called

(A) bits (B) binits

(C) nibble (D) byte

(E) Answer not known

71. A circuit that can run in either of the two modes : Monostable or astable is

(A) 555 Timer IC (B) 744 op amp IC

(C) RS Flip Flop IC (D) Monostable IC

(E) Answer not known

72. Indicate, which of the following is/are true?

(a) Schmitt trigger is a wave shaping circuit

(b) Schmitt trigger can be used as a voltage comparator

(c) The hysterisis in Schmitt trigger is valuable in conditioning noisy signals enabling them to be used in digital circuits

(A) (a), (b), (c) true
(B) (a), (c) true, (b) false
(C) (b), (c) true, (a) false
(D) (a), (b) true, (c) false
(E) Answer not known

73. Two voltages of +0.6 V and –1.4 V are applied to the two input resistors of a summing amplifier. $R_1 = 400\ \text{k}\Omega$, $R_2 = 100\ \text{k}\Omega$ $R_f = 100\ \text{k}\Omega$. Determine the output voltage.

(A) 2.5 V
(B) 1.25 V
(C) 2.00 V
(D) 1.4 V
(E) Answer not known

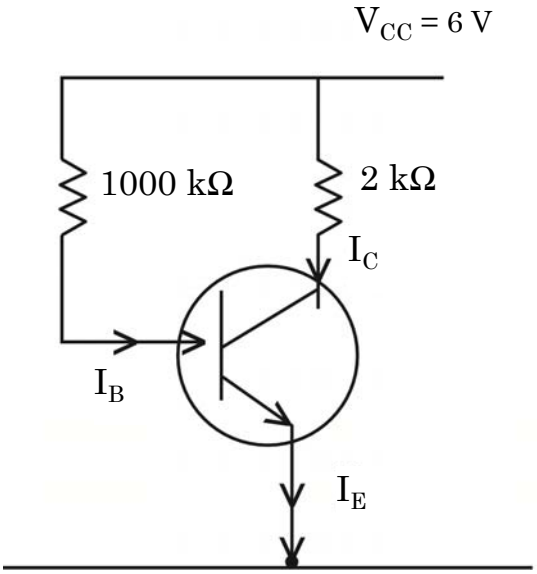
74. For a clapp oscillator the equivalent capacitance is given by

(A) $\dfrac{1}{C_1 + C_2 + C_3}$
(B) $\dfrac{1}{1/C_1 + 1/C_2 + 1/C_3}$
(C) $C_1 + C_2 + C_3$
(D) $\dfrac{C_1 C_2}{C_2 + C_3}$
(E) Answer not known

75. If the primary winding of a Transformer acts as collector load and the secondary winding is connected to the base of the next stage transistor, then this coupling is called

(A) Direct coupling
(B) Collector-base coupling
(C) Transformer coupling
(D) RC coupling
(E) Answer not known

76. In a base-resistor biased silicon transistor with $\beta = 100$, Find the operating point.



(A) 4.86 V, 0.57 mA
(B) 3.9 V, 0.57 mA
(C) 0.57 V, 3.9 mA
(D) 0.57 V, 4.86 mA
(E) Answer not known

77. A 9V output rectifier circuit based power supply would use one of the following as filter capacitor

(A) Mica Capacitor
(B) Electrolytic Capacitor
(C) Paper Capacitor
(D) Air Capacitor
(E) Answer not known

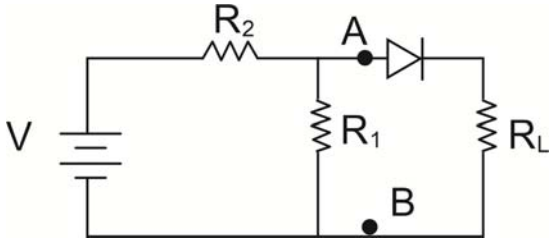
78. The junction barrier potential across each junction in a silicon bipolar transistor is

(A) 1 eV
(B) 0 V
(C) 0.7 V
(D) 1 V
(E) Answer not known

79. If a Zener diode has a maximum Zener Current of 40 mA, and if $V_Z = 10$ V the max power dissipation is

(A) 0.4 m watts
(B) 40 m watts
(C) 40 watts
(D) 0.4 watts
(E) Answer not known

80. Refer to the following circuit. State the condition of the diode.



(A) Bipolar
(B) Forward biased
(C) Reverse biased
(D) Poorly bipolar
(E) Answer not known

81. A discrete system is described by

$y(n) = 0.8y(n-2) + x(n)$

The system belongs to which category?

(A) FIR, non-recursive system and 2nd order
(B) Recursive system with 2nd order
(C) Memoryless and linear system
(D) Non-linear and non recursive system
(E) Answer not known

82. A casual LTI system has impulse response $h(n) = (0.8)^n\, u(n)$. Its frequency response magnitude at $\omega = 0$ is ————————.

(A) 10
(B) 5
(C) 0.8
(D) 0.2
(E) Answer not known

83. Two discrete time systems with impulse response $h_1(n) = \delta(n-1)$ and $h_2(n) = \delta(n-2)$ are connected in cascade. The overall impulse response of the cascaded system is

(A) $\delta(n-1) + \delta(n-2)$ (B) $\delta(n-4)$

(C) $\delta(n-3)$ (D) $\delta(n-1)\ \delta(n-2)$

(E) Answer not known

84. The result of the convolution $x(-t) * \delta(-t-t_0)$ is

(A) $x(t+t_0)$ (B) $x(t-t_0)$

(C) $x(-t+t_0)$ (D) $x(-t-t_0)$

(E) Answer not known

85. Two systems with impulse responses $h_1(t)$ and $h_2(t)$ are connected in cascade. Then the overall impulse response of the cascaded system is given by

(A) Product of $h_1(t)$ and $h_2(t)$

(B) Sum of $h_1(t)$ and $h_2(t)$

(C) Convolution of $h_1(t)$ and $h_2(t)$

(D) Subtraction of $h_1(t)$ from $h_2(t)$

(E) Answer not known

86. The Fourier Series of a real periodic function has only

1. Cosine terms if it is even
2. Sine terms if it is odd
3. Cosine terms if it is odd
4. Sine terms if it is even

Which of the above statements are correct?

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

87. The input and output of a continuous time system are denoted by $x(t)$ and $y(t)$ respectively, which of the following system corresponds to causal system

(A) $y(t) = x(t-2) + x(t+4)$ (B) $y(t) = (t-4)\,x(t+1)$
(C) $y(t) = (t+4)\,x(t-1)$ (D) $y(t) = (t+5)\,x(t+5)$
(E) Answer not known

88. The bilateral laplace transform of a function

$$f(t) = \begin{cases} 1, \text{ if } a \le t \le b \\ 0 \text{ otherwise} \end{cases}$$

(A) $\dfrac{a-b}{s}$ (B) $\dfrac{e^2(a-b)}{s}$
(C) $\dfrac{e^{-as} - e^{-bs}}{s}$ (D) $\dfrac{e^{s(a-b)}}{s}$
(E) Answer not known

89. Consider the following statements for a system given by

$$y(n) = x(n) \sum_{k=-\infty}^{\infty} \delta(n - 3k)$$

1. The system is linear
2. The system is non-linear
3. The system is causal
4. The system is non-causal

Which of the above statements is/are correct?

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

90. The special case of finite duration sequence is given as

$$x(n) = \{2, 4, 0, 3\}$$
$$\uparrow$$

The sequence $x(n)$ decomposed into a sum of weighted impulse sequences will be

(A) $2\,\delta(n+1) + 4\,\delta(n) + 3\,\delta(n-2)$
(B) $2\,\delta(n) + 4\,\delta(n-1) + 3\,\delta(n-3)$
(C) $2\,\delta(n) + 4\,\delta(n-1) + 3\,\delta(n-2)$
(D) $2\,\delta(n+1) + 4\,\delta(n) + 3\,\delta(n-1)$
(E) Answer not known

91. Consider the following relations of continuous time unit impulse function

1. $\delta(t)=\delta(-t)$

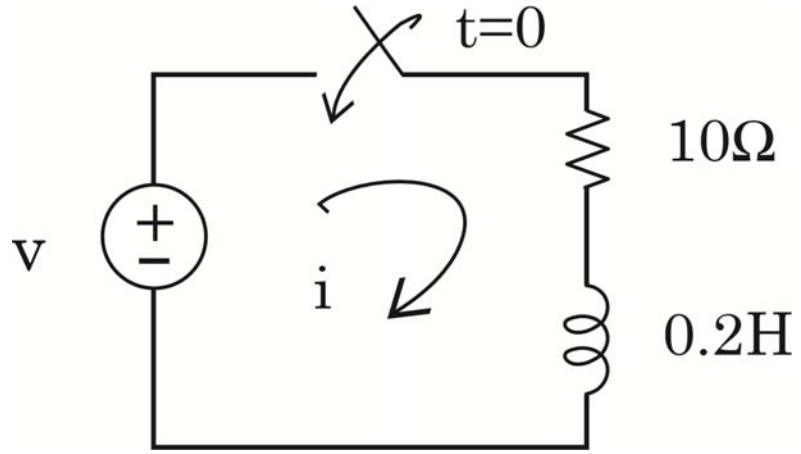
2. $\int_{-\infty}^{+\infty} x(t)\,\delta(t)=x(0)=0$

3. $\delta(at)=\frac{1}{|a|}\,\delta(t)$

Which of the above relations is/are correct?

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

92. In the series RL circuit, an exponential voltage $v=50e^{-100t}(v)$ is applied by closing the switch at $t=0$. Find the resulting current



(A) $5e^{-100t}-5e^{-50t}$

(B) $5e^{-100t}$

(C) $-5e^{-100t}+5e^{-50t}$

(D) $10e^{-100t}$

(E) Answer not known

93. A series combination of $R=10\Omega$ and $L=20mH$ has a current $i=5\cos(500t+10^{\circ})$ A. Obtain the voltage v_L across the inductor

(A) $50\cos\left(500t+10^{\circ}\right)$

(B) $70.7\cos\left(500t+55^{\circ}\right)$

(C) $50\cos\left(500t+100^{\circ}\right)$

(D) $100\sin\left(500t+10^{\circ}\right)$

(E) Answer not known

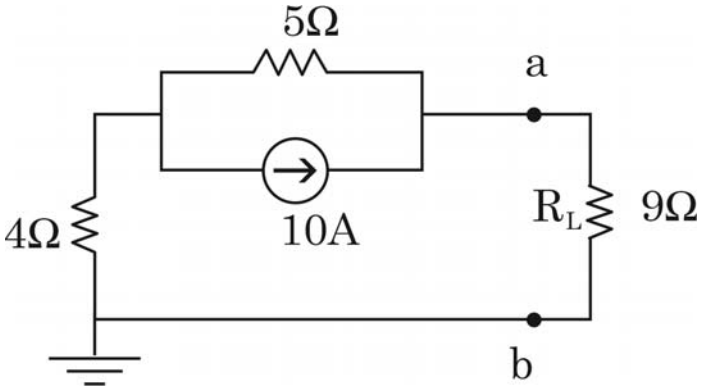
94. Two-Port Networks are cascaded and the Parameters of the network are obtained by multiplying the individual

(A) Z-Parameter matrix
(B) Y-Parameter matrix
(C) h Parameter matrix
(D) ABCD parameter matrix
(E) Answer not known

95. In a series RLC circuit, setting R = 0 will produce,

(A) An overdamped response
(B) A critically damped response
(C) An underdamped response
(D) An undamped response
(E) Answer not known

96. Find the Norton current for the circuit given



(A) 0 A

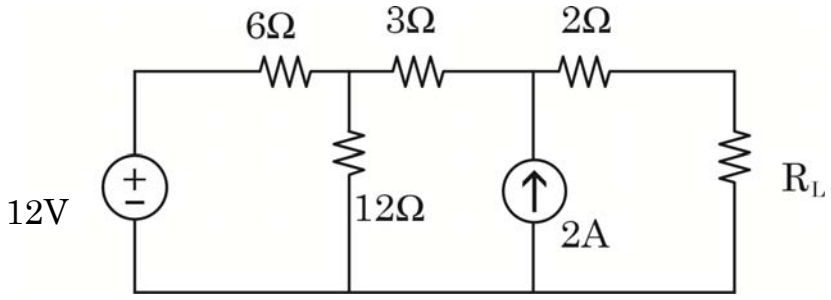
(B) 4.44 A

(C) 5.56 A

(D) 10 A

(E) Answer not known

97. Find the value of R_L for maximum power transfer in the circuit



(A) 2Ω

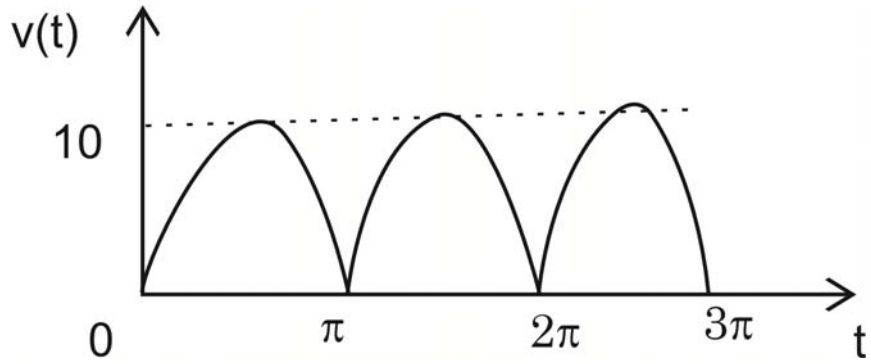
(B) 9Ω

(C) 7Ω

(D) 23Ω

(E) Answer not known

98. Find the rms value of the full wave rectified sine wave in fig.



(A) 5 V
(B) 7.071 V
(C) 10 V
(D) 14.14 V
(E) Answer not known

99. Maximum power is transferred when load resistance is

(A) Equal to source resistance
(B) Equal to zero
(C) Equal to half of the source resistance
(D) Equal to infinite
(E) Answer not known

100. A DC power supply delivers 40 W of power to a resistive load. If the source generates a total of 50 W, What is the DC operating efficiency of the system?

(A) 40%
(B) 50%
(C) 80%
(D) 125%
(E) Answer not known

101. One of the following is not used for impedance matching

(A) Single stub
(B) Quarter wave transformer
(C) Attenuator
(D) Double stub
(E) Answer not known

102. A lossless transmission line of length 0.5 m is operated at 300 MHz. It's electrical length in degree is,

(A) 90
(B) 180
(C) 270
(D) 360
(E) Answer not known

103. A lossless transmission line with characteristic impedance $Z_0 = 50\,\Omega$ is 30 m long and operates at 2 MHz. The line is terminated with a load impedance of $Z_L = 60 + j40\,\Omega$. The normalized load impedance value is,

(A) $1 + j0.8\,\Omega$

(B) $1.2 + j0.8\,\Omega$

(C) $1.2 + j1.8\,\Omega$

(D) $0.2 + j0.8\,\Omega$

(E) Answer not known

104. The characteristic impedance of a Lossy transmission line is

(A) $\sqrt{(R + jWL)\,(G + jWC)}$

(B) $\sqrt{\dfrac{R + jWL}{G + jWC}}$

(C) $\sqrt{(R + jWC)\,(G + jWL)}$

(D) $\sqrt{\dfrac{R + jWC}{G + jWL}}$

(E) Answer not known

105. The skin depth (δ) for the plane wave propagation in good conductors is, any of the following :

(A) $\sqrt{\pi f \mu \sigma}$

(B) $\frac{1}{\sqrt{\pi f \mu \sigma}}$

(C) $\sqrt{2\pi f \mu \sigma}$

(D) $\sqrt{\frac{\pi f \mu \sigma}{2}}$

(E) Answer not known

106. Polarization of an electromagnetic wave can be described by identifying the variation and orientation of

(A) Magnetic field
(B) Power density
(C) Electric field
(D) Poynting vector
(E) Answer not known

107. A uniform plane wave in medium 1, the incident electric field strength is 10 V/m and the incident magnetic field strength is 2 mA/m. The value of intrinsic impedance (D_1) in medium 1 is,

(A) 2 kΩ
(B) 5 kΩ
(C) 10 kΩ
(D) 20 kΩ
(E) Answer not known

108. As per the statement of Poynting's theorem, which one of the following represents the ohmic power dissipated with in the volume?

(A) $-\int_v \frac{E^2}{\sigma} dv$

(B) $-\int_v \sigma E^2 dv$

(C) $-\int_v \sigma^2 E dv$

(D) $-\int_v \frac{\sigma}{E^2} dv$

(E) Answer not known

109. A current of 5A passes through an inductor having an inductance value of 2 mH. The amount of magnetic energy stored by an inductor in Joules is,

(A) 10×10^{-3}

(B) 50×10^{-3}

(C) 25×10^{-3}

(D) 100×10^{-3}

(E) Answer not known

110. Two magnetically coupled coils are connected in parallel. If the mutual flux opposes the individual fluxes, the equivalent inductance L_T is given by

(A) $L_T = \frac{L_1 L_2 - M^2}{L_1 + L_2 - 2M}$

(B) $L_T = \frac{L_1 L_2 + M^2}{L_1 + L_2 + 2M}$

(C) $L_T = \frac{L_1 L_2 - M^2}{L_1 + L_2 + 2M}$

(D) $L_T = \frac{L_1 L_2 + M^2}{L_1 + L_2 - 2M}$

(E) Answer not known

111. A 10 cm long conductor carrying a 50A current is placed perpendicular to a magnetic field of strength 1000 A/m. Find the force acting on the conductor

(A) 2.68×10^{-3} N
(B) 6.28×10^{-3} N
(C) 8.26×10^{-3} N
(D) 8.86×10^{-3} N
(E) Answer not known

112. The differential force between two current elements $Id\vec{l}$ in a magnetic field $\vec{B}$ is

(A) $d\vec{F} = I\, d\vec{l} \times \vec{B}$
(B) $d\vec{F} = Id\vec{l} + \vec{B}$
(C) $d\vec{F} = I\vec{B} \times d\vec{l}$
(D) $d\vec{F} = I\vec{B} + d\vec{l}$
(E) Answer not known

113. The total magnetic flux passing through a closed surface is equal to

(A) Current I
(B) Charge Q
(C) Field B
(D) Zero
(E) Answer not known

114. The equation $V_{emf} = \oint_l \vec{E}m \cdot d\vec{l} = \oint_l (\vec{u} \times \vec{B}) \cdot d\vec{l}$ is not representing

(A) Motional emf
(B) Flux-cutting emf
(C) Alternator emf
(D) Transformer emf
(E) Answer not known

115. Which one of the following is not a source of magnetic field?

(A) A DC current in a wire
(B) A permanent magnet
(C) Change of electric field
(D) An accelerated charge
(E) Answer not known

116. Energy stored in a capacitor is given by

(A) CV joules
(B) $\frac{1}{2}$ CV joules
(C) CV^2 joules
(D) $\frac{1}{2}$ CV^2 joules
(E) Answer not known

117. A parallel plate capacitor with a supply voltage of 20V, generates a charge magnitude of 60 μC across the plates. The capacitance value of the parallel plate geometry is,

(A) 3 μF
(B) 120 μF
(C) 1200 μF
(D) 30 μF
(E) Answer not known

118. The maximum electric field that a dielectric can withstand without electrical breakdown is,

(A) Capacitance
(B) Dielectric strength
(C) Inductance
(D) Resistance
(E) Answer not known

119. Point charges $Q_1 = 1\,\text{nc}$ and $Q_2 = 2$ nc are at a distance of 4m apart. Which of the following statement is incorrect?

(A) The force on Q_1 is repulsive

(B) The force on Q_2 is repulsive

(C) The force on Q_2 is the same in magnitude as that on Q_1

(D) If the distance reduces then the force on Q_1 increases

(E) Answer not known

120. As per Gauss's law, the total electric flux through any closed surface is equal to

(A) Electric field intensity

(B) Charge enclosed by that surface

(C) Current enclosed by that surface

(D) Energy enclosed by that surface

(E) Answer not known

121. Match the following :

Lighting Scheme	Amount of Light Received
(a) Direct Lighting	1. 90-100% of light directed downwards
(b) Semidirect Lighting	2. Equal distribution of light upwards & downwards
(c) General diffuse lighting	3. 60-90% of light directed upwards, rest downwards
(d) Semi indirect lighting	4. 90-100% of light directed upwards
(e) Indirect lighting	5. 60-90% of light directed downwards, rest upwards

	(a)	(b)	(c)	(d)	(e)
(A)	5	4	3	2	1
(B)	5	2	4	3	1
(C)	1	5	2	3	4
(D)	1	3	4	5	2

(E) Answer not known

122. How many points are permitted in a single sub-circuit as per ISI standards?

(A) 4 (B) 3

(C) 2 (D) 1

(E) Answer not known

123. If the total sensible heat and total latent heat of the room are 1,20,000 kJ and 60,000 kJ respectively, then the sensible heat factor is

(A) 46%
(B) 56.67%
(C) 78%
(D) 66.67%
(E) Answer not known

124. Which one of the following must be kept in mind while determining the size of the conductor for internal wiring for a given circuit?

(A) minimum size of conductor & voltage drop
(B) current carrying capacity & minimum size of conductor
(C) voltage drop & current carrying capacity
(D) minimum size of conductor, voltage drop and current carrying capacity
(E) Answer not known

125. A 100 C.P lamp is hung 5 metres above the centre of a circular area of 8 metre diameter. What will be the illumination at the centre of area?

(A) 7.5 lux
(B) 3.5 lux
(C) 4 lux
(D) 3 lux
(E) Answer not known

126. If w represents angular velocity of rotor, R represent tip radius and V_∞ represents free stream wind speed, then the tip speed ratio (λ) of the wind turbine is

(A) $\lambda = wR / V_\infty$

(B) $\lambda = V_\infty / w$

(C) $\lambda = wR$

(D) $\lambda = V_\infty / wR$

(E) Answer not known

127. Maximum Power Point Tracking on a Solar Panel is obtained at

(A) Open Circuit Voltage (V_{OC}) on V–I characteristics

(B) Short Circuit Current (I_{SC}) on V–I characteristics

(C) Product of Open Circuit Voltage (V_{OC}) and Short Circuit Current (I_{SC})

(D) Product of voltage and current at its absolute peak on V–I characteristics

(E) Answer not known

128. Which of the following is the primary driving source responsible for the formation of wind?

(A) Ocean currents

(B) The rotation of moon

(C) Uneven heating of the atmosphere by the sun

(D) Geothermal heat

(E) Answer not known

129. Which one of the following are the characteristics of Savonius rotor of wind energy system?

(A) self starting only
(B) low speed only
(C) low speed and low efficiency
(D) self starting, low speed and low efficiency
(E) Answer not known

130. According to Betz theory, what is the maximum limit for the power coefficient?

(A) 0.753
(B) 1
(C) 0.333
(D) 0.593
(E) Answer not known

131. V2G technology allows EV users to

(A) Only consume electricity
(B) Store electricity only
(C) Buy and sell electricity to the grid
(D) Stop charging completely
(E) Answer not known

132. Ni-Cd batteries typically operate over a temperature range of

(A) 0°C to 50°C
(B) –10°C to 60°C
(C) –40°C to 85°C
(D) –20°C to 40°C
(E) Answer not known

133. In a vehicle performance analysis using standard drive cycles, why are drive cycles important in power train design?

(A) They find the maximum battery voltage required for the vehicle

(B) They represent real traffic conditions and helps to identify most frequently used operating region of tractive effort

(C) They are used only to calculate maximum vehicle speed under ideal conditions

(D) They eliminate the need for aerodynamic drag consideration

(E) Answer not known

134. During vehicle acceleration, the super capacitor primarily provides

(A) Long term energy supply

(B) Rapid power delivery

(C) Battery charging

(D) Grid synchronization

(E) Answer not known

135. Assertion [A] : Fuel cell can operate on methanol, ethanol and natural gas.

Reason [R] : These fuels having rich oxygen and carbon and can be reformed to extract CO_2.

(A) Both [A] and [R] are true, [R] explains [A]

(B) Both [A] and [R] are true but [R] does not explain [A]

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

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

(E) Answer not known

136. What is the maximum or peak intensity of direct solar radiation reaching the earth surface on a clear day at sea level?

(A) 1500 Watt/square metre
(B) 1000 Watt/square metre
(C) 2000 Watt/square metre
(D) 1250 Watt/square metre
(E) Answer not known

137. The correct statement about plastic solar cells with nanotechnology is

(A) They are more efficient than conventional semiconductor solar cells and require high vacuum fabrication
(B) They are cheaper to manufacture, but have lower efficiency than to semiconductor solar cells
(C) They can only be fabricated under high vacuum and very high temperature conditions (400°C – 1400°C)
(D) They use only inorganic semiconductor without any polymer materials
(E) Answer not known

138. Which of the following are types of photovoltaic (PV) cell technologies?

(A) Amorphous silicon, polycrystalline silicon and single crystal silicon
(B) Coal, natural gas and petroleum
(C) Biomass, geothermal and hydropower
(D) Diesel, petrol and kerosene
(E) Answer not known

139. Match energy sources with CO_2 emissions (g/kwh)

	Energy source		CO_2 Emission
(a)	Coal	1.	9
(b)	Wind	2.	955
(c)	Solar photovoltaic	3.	167
(d)	Diesel	4.	772

	(a)	(b)	(c)	(d)
(A)	3	2	4	1
(B)	2	1	3	4
(C)	4	3	1	2
(D)	1	4	2	3

(E) Answer not known

140. Which instrument is used to measure global or diffuse solar radiation on a horizontal surface?

(A) Pyrheliometer
(B) Sunshine recorder
(C) Pyranometer
(D) Heliostat
(E) Answer not known

141. In chopper fed separately excited DC motor, the speed range for regenerative braking is

(A) $\frac{K_m}{V_s + I_a R_a} : I_a r_a$
(B) $\frac{(1-\alpha) V_a}{I_a} + r_a : \frac{E_a}{I_a}$
(C) $\frac{(1-\alpha) V_a + I_a r_a}{K_m} : L_a \frac{d_i}{d_t}$
(D) $\frac{V_s + I_a r_a}{K_m} : \frac{I_a r_a}{K_m}$
(E) Answer not known

142. Half controlled 3-phase converters fed DC drives are employed upto _____ rating applications in practice for _____ quadrant operation.

(A) 250 HP, Second
(B) 125 HP, First
(C) 200 HP, Second
(D) 325 HP, First
(E) Answer not known

143. The maximum torque capability of self controlled synchronous motor is limited by

(A) Rotor Cu loss
(B) Converter current rating
(C) Mechanical bearing friction
(D) Supply frequency
(E) Answer not known

144. When operated with variable frequency, a synchronous motor has an advantage over an induction motor?

(i) That it is free from torque oscillations
(ii) That is has very good efficiency
(iii) That the line power factor be improved by varying excitation
(iv) That in certain cases the inverter can be simpler configuration due to possible load commutation

(A) (i), (ii) and (iii)
(B) (i), (ii), (iii) and (iv)
(C) (i), (iii) and (iv)
(D) (ii), (iii) and (iv)
(E) Answer not known

145. In 3ϕ induction motor drive, let V and f denote the rated voltage and frequency of the motor. When the motor is operated below the base speed with constant $\left(V/f\right)$ control, for a frequency Kf, the terminal voltage will be KV, where K is a factor such that

(A) $0 \le K \le 1$ (B) $1 \le K \le 2$

(C) $1 \le K \le 0$ (D) $2 \le K \le 1$

(E) Answer not known

146. In connection with DC motor drives match the following :

(a) Shunt motor drive	1. $T = K_e K_f I_a^2$
(b) Series motor drive	2. $W_m = \frac{V}{K_e^{\phi}} - \frac{R_a}{(K_e^{\phi})^2} T$
(c) Separately excited motor drive	3. $W_m = \frac{V - I_a R_a}{K_e(\phi_{sh} \pm \phi_{se})}$
(d) Compound motor drive	4. $Ke\phi = K$ and $T = KI_a$

	(a)	(b)	(c)	(d)
(A)	4	3	2	1
(B)	1	4	3	2
(C)	3	2	1	4
(D)	2	1	4	3

(E) Answer not known

147. Primary disadvantages of phase controlled converter fed motor drives is/are

(a) Constant air gap flux operation

(b) Field time constant is at least 10 to 100 times greater than the armature time constant

(c) Reactive power consumption

(d) Generation of Harmonics

(A) (a) and (b)
(B) (a), (b) and (c)
(C) (c) and (d)
(D) (b), (c) and (d)
(E) Answer not known

148. An electric drive shows load torque increasing linearly with speed. This load is most likely

(A) Conveyor
(B) Lathe Machine
(C) Fan
(D) Hoist
(E) Answer not known

149. What is the effect when viscous friction coefficient is negligible in electrical motor-load drive system?

(A) No oscillations
(B) Shaft breaks
(C) No effect
(D) Smooth operation
(E) Answer not known

150. A single-phase full-wave ac voltage controller has a resistive load of $R = 5\Omega$ and the ac source voltage of 230 V, 50 Hz. The delay angles of thyristors (T_1 and T_2) are equal to $\pi/2$. Calculate the rms output voltage.

(A) 207.073 V
(B) 230 V
(C) 162.635 V
(D) 325.269 V
(E) Answer not known

151. For 1ϕ half bridge inverter, output $V_{01} = V_s$ and output power = P. Then corresponding values for 1ϕ full bridge inverters are

(A) V_s, P
(B) $2V_s$, P
(C) $2V_s$, 2P
(D) $2V_s$, 4P
(E) Answer not known

152. In a current limit control, the chopper is switched off, when the load current reaches,

(A) Minimum Current Limit (I_{min})
(B) Average current
(C) Maximum Current Limit (I_{max})
(D) Zero current
(E) Answer not known

153. Forced commutation in chopper circuit is required because

(A) Load current is always zero

(B) Voltage is alternating

(C) DC supply cannot naturally turn-off SCR

(D) Inductor blocks current completely

(E) Answer not known

154. How is the switching off action achieved in voltage source inverters that utilize Gate Turn-Off Thyristors (GTOs)?

(A) By applying a negative gate-current pulse

(B) By forcing the load current to zero using an auxiliary resonant circuit

(C) By applying a continuous positive gate-current pulse

(D) By reversing the polarity of the main DC voltage link

(E) Answer not known

155. In sine PWM inverter, if the zero of the triangular carrier wave coincides with the zero of the reference sinusoid, how many pulses are generated per half cycle?

(A) N pulses

(B) N + 1 pulses

(C) N – 1 pulses

(D) 2 N pulses

(E) Answer not known

156. In Dual converters,

(A) Both rectifiers provides positive current to load

(B) Both rectifiers provide negative current to load

(C) One rectifier provide positive current to load and other provide negative current

(D) One rectifier provide positive current to the source and the other negative

(E) Answer not known

157. A single-phase full converter operates in the inversion mode when the firing angle 'α' satisfies if,

(A) $0° < \alpha < 90°$ with a purely 'R' load

(B) $90° < \alpha < 180°$ and an external DC source is present in the load

(C) $\alpha = 90°$ exactly with a purely inductive load

(D) $\alpha = 0°$ with a capacitive filter

(E) Answer not known

158. A freewheeling diode is placed across the dc load.

1. Input pf is improved
2. Load current waveform is improved
3. Overall converter efficiency improves.

The correct statements are

(A) 1, 3 only

(B) 2, 3 only

(C) 1, 2 only

(D) 1, 2 and 3

(E) Answer not known

159. Choose the right matches among type.

1.	BJT	–	Voltage controlled device
2.	IGBT	–	Current controlled device
3.	TRIAC	–	Bidirectional AC switching device
4.	GTO	–	Thyristor that can be turned off by gate signal

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

160. Match the SCR state with its condition :

(a)	Reverse blocking state	1.	Anode positive w.r.t. cathode, gate triggered
(b)	Forward blocking state	2.	Anode negative w.r.t. cathode, leakage current only
(c)	Forward conduction state	3.	Reverse voltage exceeds breakdown value
(d)	Reverse breakdown state	4.	Anode positive w.r.t. cathode, gate not triggered

	(a)	(b)	(c)	(d)
(A)	2	4	1	3
(B)	2	4	3	1
(C)	4	2	1	3
(D)	4	3	1	2

(E) Answer not known

161. To protect the systems operating at high voltages against lightning is done by

(A) Rod gap arrester
(B) Horn gap arrester
(C) Multi gap arrester
(D) Valve type arrester
(E) Answer not known

162. Negative sequence relays are used for the protection of the following equipment against unbalance loading

(A) Transmission lines and feeders
(B) Generators and motor
(C) Bus bars
(D) Transformers
(E) Answer not known

163. In a 3 phase, 4 wire 400/230 V system, a lamp of 100 watts is connected to one phase and neutral and a lamp of 150 watts is connected to the second phase and neutral. If the neutral wire is disconnected accidentally, what will be the current through the lamps?

(A) 0.545 amps
(B) 0.454 amps
(C) 0.554 amps
(D) 0.445 amps
(E) Answer not known

164. An expression for the power loss in a uniformly loaded distributor fed at one end is ————

(A) $p = \frac{i^2 rl^2}{3}$ (B) $p = \frac{i^3 rl^2}{3}$

(C) $p = \frac{i^2 rl^3}{3}$ (D) $p = \frac{i^2 rl^4}{3}$

(E) Answer not known

165. The unbalanced loading on the generator will give the ————

(A) Circulation of positive sequence currents in the stator winding

(B) Circulation of negative sequence currents in the stator winding

(C) Circulation of zero sequence currents

(D) Circulation of no current

(E) Answer not known

166. The synchronous capacitor supplies VARs during peak load conditions and absorbs VARs during light load conditions by operating in

(A) Over excited and under excited modes respectively

(B) Under excited and over excited modes respectively

(C) Constant excitation mode only

(D) Zero excitation mode only

(E) Answer not known

167. The peak value of magnetizing inrush current in a transformer can be as high as

(A) 1 to 2 times of full load current

(B) 2 to 4 times of full load current

(C) 4 to 6 times of full load current

(D) 6 to 8 times of full load current

(E) Answer not known

168. Assertion [A] : During a disturbance in a synchronous generator, the system remains stable when the accelerating area exceeds the decelerating area.

Reason [R] : The equal area criterion states that for a synchronous machine to remain in the stable operation, the accelerating area must be equal to the decelerating area.

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

(B) Both [A] and [R] are true but [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

169. For a lossless transmission line, $P = \frac{V_1 V_2}{X} \sin\delta$ if $P_{\max} = 200$ MW & the transmitted power is 100 MW, then δ is

(A) 15° (B) 30°

(C) 45° (D) 60°

(E) Answer not known

170. In the universal relay torque equation $T = k_1 I^2 + k_2 V^2 + k_3 VI\cos(\theta - \tau) + k$, an over current relay is obtained when

(A) $k_1 = 0$, $k_2 = 0$ & the spring torque will be k

(B) $k_1 = 0$, $k_2 = 0$ & the spring torque will be $-k$

(C) $k_2 = 0$, $k_3 = 0$ & the spring torque will be k

(D) $k_2 = 0$, $k_3 = 0$ & the spring torque will be $-k$

(E) Answer not known

171. Stringing chart in transmission line is mainly used for

(A) Determining the sag in the conductor

(B) Designing insulator string

(C) Designing transmission towers

(D) Determining the spacing between towers

(E) Answer not known

172. Choose the correct methods for reducing corona loss

(1) Using small dia conductors

(2) Using large dia conductors

(3) Using hollow conductors

(4) Using bundled conductors

(A) (1) only

(B) (1), (3) only

(C) (1), (3), (4) only

(D) (2), (3), (4) only

(E) Answer not known

173. A transformer is rated at 11 kV/0.4 kV, 500 kVA, 5% reactance. Determine the short circuit MVA of the transformer when connected to an infinite bus.

(A) 1 MVA
(B) 5 MVA
(C) 10 MVA
(D) 20 MVA
(E) Answer not known

174. Series compensation in EHV transmission lines is mainly used for which of the following purposes?

(A) To improve system stability
(B) To reduce fault level
(C) To improve voltage profile
(D) To replace phase modifiers
(E) Answer not known

175. Match the constants of the network for a short transmission line.

Constants of the network	Value
(a) A	1. 1 (Voltage ratio)
(b) B	2. 0 (Admittance)
(c) C	3. 1 (Current ratio)
(d) D	4. Z (Transfer impedance)

	(a)	(b)	(c)	(d)
(A)	1	2	3	4
(B)	1	4	2	3
(C)	1	3	2	4
(D)	4	3	2	1

(E) Answer not known

176. The per unit value of voltage in a 108 kV line to line voltage to the base value $kV_{LL} = 120$ kV is

(A) 0.8 (B) 0.9

(C) 0.7 (D) 0.6

(E) Answer not known

177. Assertion [A] : Now a days simultaneous generation of electricity and steam for space heating in thermal power station is advisable.

Reason [R] : Tremendous amount of waste heat generated in thermal power station.

(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]

(E) Answer not known

178. A generating station has a connected load of 43 MW and a maximum demand of 20 MW and the units generated being 87.6×10^6 per annum. The values of demand factor and load factor be

(A) 0.365, 0.4 (B) 0.365, 0.35

(C) 0.465, 0.5 (D) 0.465, 0.4

(E) Answer not known

179. One gram of Uranium ^{235}U releases energy at the rate of 1 MW/day. In order to produce same amount of energy, tonnes of coal needed in thermal plant per day is

(A) 8-10
(B) 2-4
(C) 6-8
(D) 1-2
(E) Answer not known

180. Which of the following statements are true about reaction turbine?

(1) The reaction turbines has fixed and moving blades

(2) In reaction turbine the steam expands in the stationary nozzles and attains a higher velocity

(3) A partial drop of pressure is used to allow the steam into the moving blades

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

181. Which of the following statement/statements is/are correct about the parallel operation of alternators?

(i) Terminal voltage (effective) of the incoming alternator must be the same as bus bar voltage.

(ii) The speed of the incoming machine must be such that its frequency need not equal bus bar frequency.

(iii) The phase of the alternator voltage must be identical with the phase of the bus bar voltage.

(A) (i) and (ii) only
(B) (ii) and (iii) only
(C) (i) and (iii) only
(D) (ii) only
(E) Answer not known

182. A hybrid VR stepping motor has 8 main poles which have been castleated to have 5 teeth each. If rotor has 50 teeth. Calculate the stepping angle.

(A) 1.8°
(B) 10°
(C) 40°
(D) 50°
(E) Answer not known

183. Find the stepping angle for 3 phase 24 pole PM stepper motor.

(A) 3°/step

(B) 5°/step

(C) 7°/step

(D) 8.2°/step

(E) Answer not known

184. Synchronous motor speed is controlled by varying

(A) field excitation

(B) supply frequency only

(C) both supply voltage and frequency

(D) supply voltage

(E) Answer not known

185. Assertion [A] : An switch reluctance motor is meant for continuous rotation.

Reason [R] : Closed loop control is generally essential for its optional performance.

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

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

(C) [A] and [R] are true and [R] is the correct explanation of [A]

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

(E) Answer not known

186. In shaded pole single phase motor, the direction of rotation of motor is

(A) From shaded pole to unshaded pole

(B) From unshaded to shaded pole

(C) Either (A) or (B)

(D) Depends on how supply terminal is connected with stator winding

(E) Answer not known

187. Assertion [A] : At stand still, a single phase induction motor develops zero starting torque.

Reason [R] : Forward and backward rotating fields produce equal and opposite torques at stand still.

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

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

(C) Both [A] and [R] are true and [R] is correct explanation of [A]

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

(E) Answer not known

188. A dc series motor when connected across an ac supply will

(A) develop torque in the same direction

(B) not develop any torque

(C) draw dangerously high current

(D) develop a pulsating torque

(E) Answer not known

189. In squirrel cage induction motor, the rotor is

(A) open circuited

(B) permanently short circuited

(C) temporary short circuited

(D) wound with slip rings

(E) Answer not known

190. A synchronous motor absorbing 60 kW is connected in parallel with a factory load of 240 kW having a lagging p.f. of 0.8 if the combined load has a p.f. of 0.9. Identify the valve of the leading KVAR supplied by the motor.

(A) 30.4 KVAR

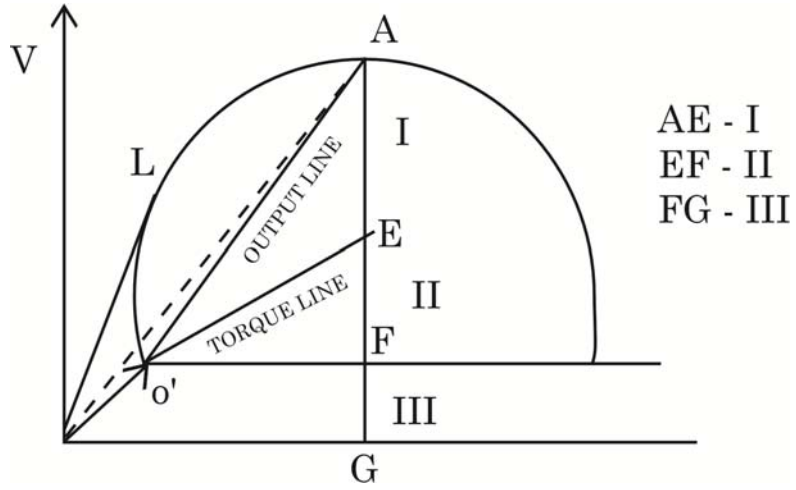
(B) 35 KVAR

(C) 38.2 KVAR

(D) 39 KVAR

(E) Answer not known

191. Identify the losses from the circle diagram.



(A) I → Fixed loss, II → Rotor cu.loss, III → stator cu.loss

(B) I → Rotor cu.loss, II → Stator cu.loss, III → Fixed loss

(C) I → Stator cu.loss, II → Fixed loss, III → Rotor cu.loss

(D) I → Rotor cu.loss, II → Fixed loss, III → Stator cu.loss

(E) Answer not known

192. A 3-phase, 6 pole, 50 Hz induction motor develops maximum torque at 940 rpm. The rotor resistance per phase is 0.1 Ω. Find the stand still rotor reactance.

(A) 0.5 Ω

(B) 0.8 Ω

(C) 1 Ω

(D) 1.66 Ω

(E) Answer not known

193. What is the slip value of an induction motor at starting?

(A) S = 0

(B) S = 0.5

(C) S = 1

(D) S = ∞

(E) Answer not known

194. The advantage of autotransformer over the equivalent two winding transformer is

(A) No electrical isolation

(B) Greater short circuit current

(C) Higher excitation current

(D) Lower leakage reactance

(E) Answer not known

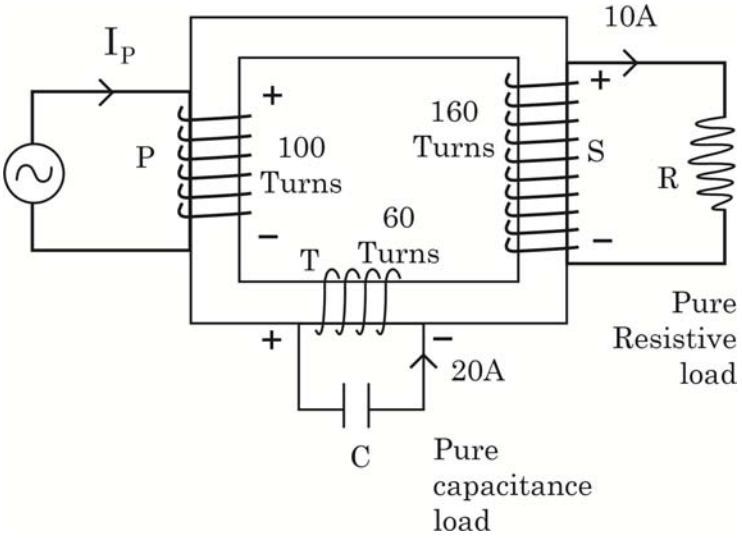
195. If the synchronous speed of a 4 pole induction motor is 1500 rpm and the rotor speed is 1470 rpm, the slip is

(A) 0.02 (B) 0.03

(C) 0.04 (D) 0.05

(E) Answer not known

196. An ideal transformer has three windings :



- 100 turns on Primary winding (P)
- 160 turns on Secondary winding (S)
- 60 turns on Tertiary winding (T)

Winding S feeds 10 A to pure resistive load, whereas pure capacitance load across winding T takes 20 A.

Find the current in primary winding and its power factor in case transformer magnetizing current is neglected.

(A) 16 A, P.F = 0.6

(B) 20 A, P.F = 0.8

(C) 30 A, P.F = 0.6

(D) 36 A, P.F = 0.8

(E) Answer not known

197. Match List I and List II.

List I Types of Generators	List II Applications
(a) DC shunt generator	1. Boosters in DC distribution system
(b) DC series generator	2. Battery charging
(c) DC differentially compound generator	3. Electric railway traction
(d) DC cumulative compound generator	4. Electric Arc welding with drooping voltage characteristic

	(a)	(b)	(c)	(d)
(A)	3	4	1	2
(B)	2	1	4	3
(C)	1	2	3	4
(D)	4	3	2	1

(E) Answer not known

198. In DC machines, laminated core is used in Armature mainly to reduce

(A) Copper losses
(B) Eddy current losses
(C) Hysteresis losses
(D) Mechanical losses
(E) Answer not known

199. A shunt generator delivers 450 A at 230 V and the resistance of the shunt field and armature are 50Ω and 0.03Ω respectively. Calculate the Armature Voltage drop.

(A) 13 V
(B) 13.3 V
(C) 13.6 V
(D) 13.9 V
(E) Answer not known

200. In a DC generator, the effect of armature reaction on the main pole flux is to

(A) Reduce it
(B) Distort it
(C) Reverse it
(D) Reduce and Distort it
(E) Answer not known

———————