ELECTRICAL ENGINEERING

PAPER–I

1. A set of independent current measurements taken by four observers was recorded as: 117.02 mA, 117.11 mA, 117.08 mA and 117.03 mA. What is the range of error?
   a. ± 0045
   b. ± 0054
   c. ± 0065
   d. ± 0056

2. The reference voltage and the input voltage are sequentially connected to the integrator with the help of a switch in a
   a. Successive approximation A/D converter
   b. Dual slope integration A/D converter
   c. Voltage to time converter
   d. Voltage to frequency converter

3. A single channel digital storage oscilloscope uses a 12 bit, 10^8 samples/s ADC. For a 10 kHz sine wave input, what is the number of samples taken per cycle of input?
   a. 10^{12}
   b. 10^8
   c. 10^4
   d. 10^2

4. Consider the signal:
   $V_m \sin 100t + 2 V_m \sin 200t$
   to be sampled and stored in a data acquisition system. The same is to be extracted off-line later on. In order to extract the signal effectively, the original sampling frequency has to be
   a. 100 rad/s
   b. 200 rad/s
   c. 210 rad/s
   d. $\sqrt{100^2 + 200^2}$ rad/s

5. Which one of the following transmission systems for telemetry has largest bandwidth?
   a. FM/FM radio transmission system
   b. Co-axial copper cables transmission system
   c. Fibre-optic data transmission system
   d. Synchro-position repeater system

6. Why are dummy strain gauges employed?
   a. For calibration of strain gauges
   b. For increasing the sensitivity of the bridge
   c. For compensation of temperature variations
   d. For neutralizing the influence of bridge voltage supply variations

7. Match List I (Type of DVM) with List II (Sub-component in ADC) and select the correct answer using the codes given below the lists:

   List I
   A. Ramp type
   B. Dual-slope
   C. Servo-type
   D. Successive approximation

   List II
   1. DAC
   2. Voltage to time converter
   3. Pulse-generator
   4. Potentiometer
   5. Capacitor

   Codes;

	A	B	C	D
a.	2	1	4	5
b.	4	5	3	1
c.	2	5	4	1
d.	4	1	3	5

8. In modern electronic multi meter a FET or MOSFET is preferred over BJT because
   a. Its input resistance is low
   b. Its input resistance is high
   c. Its input resistance is high and does not vary with the change of range
   d. It is cheaper

9. Which of the following bridges can be used for inductance measurement?
   1. Maxwell's bridge 2. Schering bridge
   2. Wein bridge 4. Hay's bridge
   3. Wheatstone bridge

   Select the correct answer using the codes given below
   a. 1 and 2
   b. 2 and 3
   c. 3, 4 and 5
   d. 1 and 4

10. Match List I (Frequency) with List II (Detector) and select the correct answer using the codes given below the lists

    List I
    A. Zero frequency
    B. 50 Hz
    C. 1200 Hz
    D. 10 kHz

    List II
    1. Head phone
    2. D'Arsonval galvanometer
    3. Cathode ray oscilloscope
    4. Vibration galvanometer
    5. Ballistic galvanometer

    Codes;

	A	B	C	D
a.	2	1	5	3
b.	3	4	1	2
c.	2	4	1	3
d.	3	1	5	2

11. Which of the following factors decide the accuracy in a bridge measurement?
    1. Accuracy of the null indicator
    2. Accuracy of the bridge components.
    3. Sensitivity of the null indicator.
    4. Applied voltage to the bridge system.

    Select the correct answer using the code given below
    a. 1 and 2
    b. 2 and 3
    c. 3 and 4
    d. 1 and 3

12. Match List I (Material Used in Instruments) with List II (Purpose) and select the correct answer using the code given below the lists:

    List I
    A. Phosphor-bronze
    B. Manganin
    C. Aluminium
    D. Eureka

    List II
    1. Coils
    2. Discs
    3. Control Springs
    4. Shunts
    5. Multipliers

    Codes;

	A	B	C	D
a.	3	5	2	4
b.	2	4	1	5
c.	3	4	2	5
d.	2	5	1	4

13. Match List I (type of Electronic Voltmeter) with List II (Major Characteristic) and select the correct answer using the code given below the lists:

    List I
    A. Amplifier-rectifier
    B. Rectifier-amplifier
    C. True R.M.S.
    D. Logarithmic

    List II
    1. Wide input-signal dynamic range
    2. High sensivity, limited bandwidth
    3. Limited sensivity, large bandwidth
    4. Capability to read non-sinusoidal ac

    Codes;

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

14. What is the effect of inductance in the pressure coil on performance of a dynamometer type wattmeter?
    a. It reads low on lagging power factor and high on leading power factor
    b. It reads high on lagging power factor and low on leading power factor
    c. Its reading is not affected at all
    d. It always reads low

15. To measure 5 volts, if one selects a 0 - 100 volt range voltmeter which is accurate within ± 1%, then the error in this measurement may be up to

a. ± 1.5%

b. ± 2.5%

c. ± 7.5%

d. ± 20%

16. Consider the following statements with regard to the bandwidth of a closed-loop system:

1. In systems where the low frequency magnitude is 0 dB h the Bode diagram, the bandwidth is measured at the -3dB frequency.
2. The bandwidth of the closed loop control system is a measurement of the range of fidelity of response of the system.
3. The speed of response to a step input is proportional to the bandwidth.
4. The system with the larger bandwidth provides slower step response and lower fidelity ramp response.

Which of the statements given above are correct?

a. 1, 2 and 3

b. 1, 2 and 4

c. 1, 3 and 4

d. 2, 3 and 4

17. Consider the following statements:

A first order system with a proportional controller exhibits an offset to a step input. In order to reduce the offset, it is necessary to

1. Increase the gain of proportional controller.
2. Add a derivative mode.
3. Add an -integral mode.

Select the correct answer using the code given below

a. 1, 2 and 3

b. 1 and 2

c. 2 and 3

d. 1 and 3

18. Match List I (Nyquist Plot of Loop Transfer Function of a Control System) with List II (Gain Margin in dB) and select the correct answer using the code given below the Lists

List I

A. Does not intersect the negative real axis

B. Intersects the negative real axis between 0 and (-1, jo)

C. Passes through (-1, jo)

D. Encloses (-1, jo)

List II

1. > 0

2. ∞

3. < 0

4. 0

Codes;

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

19. Which one of the following is the steady state error of a control system with step error, ramp error and parabolic error constants k_p, k_v and k_a respectively for the input $(1 - t^2)\,\mu(t)$?

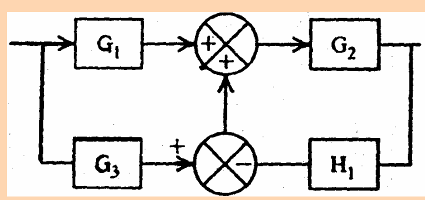
a. $\dfrac{3}{1+k_p} - \dfrac{3}{2k_a}$

b. $\dfrac{3}{1+k_p} + \dfrac{6}{2k_a}$

c. $\dfrac{3}{1+k_p} - \dfrac{3}{2k_a}$

d. $\dfrac{3}{1+k_p} - \dfrac{6}{2k_a}$

20.



What is the overall transfer function of the block diagram given above?

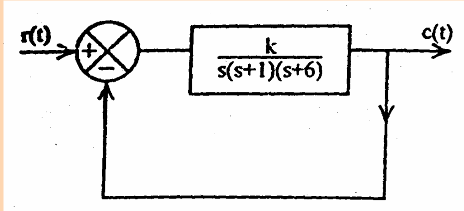
a. $\dfrac{G_1G_2 + G_2G_3}{1+G_2H_1}$

b. $\dfrac{G_1G_2 + G_2G_3}{1+G_3H_1}$

c. $G_1G_2 + G_2G_3$

d. $\dfrac{G_1G_3 + G_2G_3}{1 + G_2G_3H_1}$

21.



For which of the following values of k, the feedback system shown in the above figure is stable?

a. k > 0

b. k < 0

c. 0 < k < 42

d. 0 < k < 60

22. If the rotor axis of synchro transmitter is along the axis of S_2 stator winding, when will be the electrical zeroing?

a. $V_{S_1}V_{S_2}$ is maximum

b. $V_{S_2}V_{S_3}$ is maximum

c. $V_{S_2}V_{S_3}$ is minimum

d. $V_{S_3}V_{S_1}$ is minimum

23. The constant M-circles corresponding to the magnitude (M) of the closed loop transfer function of a linear system for values of M greater than one lie in the G-plane and to the

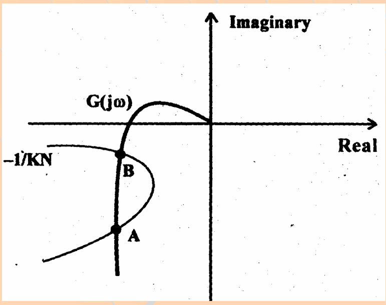
a. Right of the M = 1 line

b. Left of the M = l line

c. Upper side of the M = ± j1 line

d. Lower side of the M – j1 line

24.



Which one of the following is correct in respect of the figure given above?

a. A and B are stable limit cycles

b. A is stable limit cycle but B is unstable

c. A is unstable limit cycle but B is stable

d. Both A and B are unstable

25. Match List I (Specifications of Voltages to be Measured) with List II (Type of Most Suitable Instruments) and select the correct answer using the code given below the Lists:

List I

A. 0 - 10 mV from a source of internal resistance of 1. MΩ

B. Thermo-emf ranging up to 5 mV from a thermocouple

C. Supply voltage of 230 V, 50Hz

D. R.M.S. value of a voltage containing dc and ripples of 50 Hz and harmonic

List II

1. Thermal
2. Moving Iron
3. Permanent magnet moving coil
4. Electronic
5. Ballistic galvanometer

Codes;

	A	B	C	D
a.	2	3	5	1
b.	4	1	2	3
c.	2	1	5	3
d.	4	3	2	1

26. What are the order and type of close-loop system for the plant transfer function $G(s) = \dfrac{k}{s^2(1+Ts)}$ and with unity feedback?

a. Two and two

b. Three and two

c. Two and zero

d. Three and zero

27. The open loop transfer function of a unity feedback control system is given by $G(s) = \dfrac{k}{s(s+1)}$. If gain k is increased to infinity, then damping ratio will tend to become

a. Zero

b. 0.707

c. Unity

d. Infinite

28. The characteristic equation of a control system is given by s(s + 4)(s^2 + 2s + s) + k (s + 1) = 0

What are the angles of the asymptotes for the root loci for k ≥ 0?

a. 60°, 180°, 300°
b. 0°, 180°, 300°
c. 120°, 180°, 240°
d. 0°, 120°, 240°

29. Encirclement of origin of 1 + G(s) plane corresponds to encirclement of a point in the -1 + G(s) plane, given by

a. 1 + j0
b. 0 + j0
c. - 2 + j0
d. - 1 + j0

30. Consider the following statements regarding compensators used in control systems

1. For type-2 or higher systems, lag compensator is universally used to overcome the undesirable oscillatory transient response.
2. In case of lag-lead compensator, a lag and a lead compensator are basically connected in parallel.
3. The S-plane representation of the lead compensator has a zero closer to the origin than the pole.
4. A lag compensator improves the steady state behaviour of a system while nearly maintaining its transient response.

Which of the statements given above are correct?

a. 1, 2 and 3
b. 2, 3 and,4
c. 1 and 2
d. 3 and 4

31. The open loop transfer function of a feedback system has m poles and n zeros (m > n).

Consider the following statements:

1. The number of separate root loci is m.
2. The number of separate root loci is n.
3. The number of root loci approaching infinity is (m - n).
4. The number of root loci approaching infinity is (m + n).

Which of the statements given above are correct?

a. 1 and 4
b. 1 and 3
c. 2 and 3
d. 2 and 4

32. Match List I (Name of the Control System Component) with List II (Use of the Component in Control System) and select the correct answer using the code given below:

List I

A. Amplidyne
B. Potentiometer
C. Stepper motor
D. AC tacho-generator

List II

1. Feedback element
2. Actuator
3. Control Amplifier
4. Error detector

Codes;

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

33. The maximum temperature rise of a transformer is 50°C. It attains a temperature 31.6° in 1/2 hour. What is its thermal time constant?

a. 2 hours
b. 1/2 hour
c. 1 hour
d. 1/4 hour

34. The state equations of a system are given by

$$\dot{\underline{x}} = \begin{bmatrix} -3 & 1 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -1 \end{bmatrix} \underline{x} + \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix} x$$

The system is

a. Controllable and observable
b. Controllable but not completely observable

c. Neither controllable nor completely observable

d. Not completely controllable but observable

35. In a speed control system, output rate feedback is used to

a. Limit the speed of motor

b. Limit the acceleration of the motor

c. Reduce the damping of the system

d. Increase the gain margin

36. Consider the following equation:

$2s^4 + s^3 + 3s^2 + 5s + 10 = 0$

How many roots does this equation have in the right half of s-plane?

a. One

b. Two

c. Three

d. Four

37. Match List I (System) with List II (Transfer Function) and select the correct answer using the code given below:

List I

A. Lag Network

B. AC Servomotor

C. Field Controller dc servomotor

D. Tacho-generator

List II

1. $K\left(\dfrac{1+aTs}{1+Ts}\right)$

2. K_1S

3. $\dfrac{K}{s(1+s\tau_m)(1+s\tau_f)}$

4. $\dfrac{K}{s(1+s\tau_m)}$

Codes;

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

38. $4\dfrac{d^2y}{dt^2} + 36y = 36x$

Consider the following statements in connection with the differential equation given above

1. The natural frequency of the response is 6 rad/s.

2. The response is always oscillatory.

3. The percentage overshoot is 10% and damping ratio of the system is 0.6.

4. Both system time constant and settling time are infinite.

Which of the statements given above are correct?

a. 1 and 3

b. 2 and 4

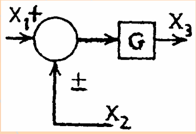
c. 1, 2 and 3

d. 2, 3 and 4

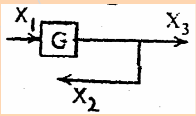
39. Match List I (Original Diagram) with List II (Equivalent Diagram) and select the correct answer using the code given below the Lists

List I

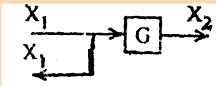
A.



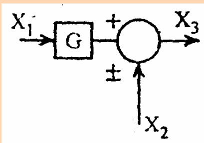
B.



C.

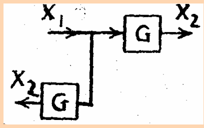


D.

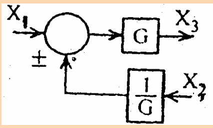


List II

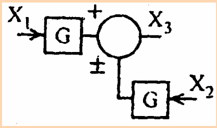
1.



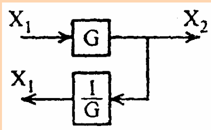
2.



3.



4.



Codes;

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

40. A 12 bit A/D converter has a range 0 - 10 V. What is the approximate resolution of the converter?

a. 1 mV

b. 2.5 mV

c. 2.5 μV

d. 12 mV

41. Pulse code modulation is commonly used in telemetry because

a. It ensures immunity from noise during transmission

b. The bandwidth requirement of the channel is reduced

c. It removes quantization error

d. It permits lower rate of sampling than what is normally required under Shanon’s theorem

42. A uniform plane wave has a wavelength of 2 cm in free space and 1 cm in a perfect dielectric. What is the relative permittivity of the dielectric?

a. 2.0

b. 0.5

c. 4.0

d. 0.25

43. What are the materials which exhibit electric polarization even in the absence of an applied electric field called?

a. Ferromagnetic

b. Paramagnetic

c. Ferroelectric

d. Anti-ferroelectric

44. The magnetic field at which a super-conductor remains in its superconducting state at a temperature less than the transition temperature is

a. Zero

b. Greater than the critical field corresponding to the given temperature

c. Less than the critical field corresponding to the given temperature

d. Equal to the critical field corresponding to the transition temperature

45. Match List I (Response) with List II (Parameter) and select the correct answer using the codes given below the Lists:

List I

A. Swiftness of transient response

B. Closeness of the response to the desired response

C. Reduction of steady state error

D. Number of integrators in loop transfer function

List II

1. Feedback control

2. Type number

3. Rise time and peak time

4. Overshoot and settling time

Codes;

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

46. Consider the following statements regarding magnetic materials:

1. Relative permeability of water is 0.99999 and that of oxygen is 1.00002; hence water is dia-magnetic and oxygen is para-magnetic material.

2. Ferrimagnetic material has no eddy current loss.

3. Permalloy and Alnico are two examples of hard magnetic materials.

4. The magnetisation and applied electric field in ferromagnetic materials are related non-linearly.

Which of the statements given above are correct?

a. 1, 2 and 3

b. 2, 3 and 4

c. 1, 3 and 4
d. 1, 2 and 4

47. The systeresis loop for the material of the core of a transformer should be
a. Short and narrow
b. Tall and narrow
c. Short and wide
d. Tall and wide.

48. All magnetic materials lose their magnetic properties when
a. Cooled to low temperature
b. Heated to high temperature
c. Kept in an aluminium box
d. Kept in vacuum

49. The electrical conductivity of a semiconductor increases with increase in temperature because
a. The mobility of the carriers increases
b. The carrier concentration increases
c. Both carrier concentration and mobility increase
d. Thermal energy of electrons increases

50. Match List I with List II and select the correct answer using the code given below the Lists:

List I
A. Non-linear system
B. Linear system
C. Time varying system
D. Multiplication in S-domain

List II
1. Principle of superposition and homogeneity and homogeneity
2. Describing function
3. Convolution integral
4. Rocket

Codes;

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

51. Which one of the following is not a permanent magnetic material?
a. Chromium steel
b. Silicon iron
c. Cobalt steel
d. Alnico

52. In metals, resistivity is composed of two parts: one part is characteristic of the particular substance. The other part is due to
a. Applied voltage
b. Crystal imperfections
c. Applied magnetic field
d. Supplied thermal energy

53. Fermi level in a p-type semiconductor lies close to
a. The top of the valence band
b. The bottom of the valence band
c. The top of the conduction band
d. The bottom of the conduction band

54. Above the Curie temperature, Ferro-magnetic materials behave like
a. Paramagnetic
b. Diamagnetic
c. Anti-ferromagnetic
d. Ferromagnetic

55. Match List I with List II and select the correct answer using the codes given below the Lists:

List I
A. Breakaway point
B. Phase margin
C. Gain margin
D. Second order system

List II
1. Stable
2. Phase cross-over frequency
3. Gain cross-over frequency
4. Root locus

Codes;

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

56. In an analog data acquisition unit, what is correct sequence of the blocks starting from the input?
a. Transducer — Recorder — Sgna1 conditioner
b. Transducer — Signal conditioner — Recorder

c. Signal conditioner — Transducer — Recorder

d. Signal conditioner — Recorder — Transducer

57. Thermistors are essentially semiconductors

a. Well suited to precision measurement of temperature

b. Widely used in the lower temperature range of -100°C to 300°C

c. Which behave as resistors with a high negative temperature coefficient of resistance

d. All of the above

58. Which one of the following frequency meter is suitable for measuring radio frequency?

a. Vibrating reed frequency meter

b. Weston frequency meter

c. Electrical resonance frequency meter

d. Hetrodyne frequency meter

59. Which one of the following digital voltmeters is most suitable to eliminate the effect of period noise?

a. Ramp type digital voltmeter

b. Integrating type digital voltmeter

c. Successive approximation type digital voltmeter

d. Servo type digital voltmeter

60. Match List I with List II and select the correct answer using the code given below the Lists:

List I

A. imaginary axis of S-plane

B. Oscillatory time domain response

C. Over damped time response

D. Poles at origin of S-plane

List II

1. Imaginary axis poles and S-plane

2. Type of the system

3. Unit circle of Z-plane

4. Poles on real axis of S-plane

Codes;

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

61. Chopper stabilized d.c. amplifier type electronic voltmeter overcomes the effect of

a. Amplifier CMRR

b. Amplifier sensitivity

c. Amplifier drift

d. Electromagnetic interference

62. Which of the following measurements can be made using Lissajous figures?

1. Frequency

2. Phase difference

3. Time interval between pulses

4. Pulse width

5. Fundamental and higher harmonic components.

Select the correct answer using the code given below

a. 1 and 2

b. 2 and 3

c. 3 and 4

d. 4 and 5

63. Wagner Earth devices in AC bridge circuits are used for

a. Shielding all the bridge elements from external magnetic field

b. Eliminating the effect of stray capacitance

c. Minimizing the effect of inter-component capacitance

d. Eliminating all the node to earth capacitances

64. Which one of the following defects is responsible for creeping in an induction type energy meter?

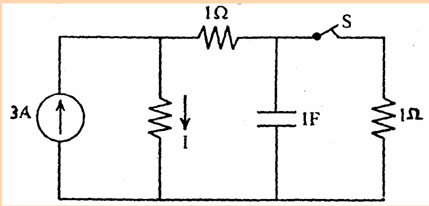
a. Imperfect lag compensation

b. Over friction compensation

c. Imperfect overload compensation

d. Misalignment of brake magnet

65.



In the circuit given above, the steady state is attained with S open. S is closed at t = 0. What is the value of current I at $t = 0^+$?

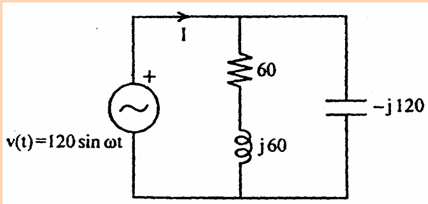
a. 2 A

b. 2.25 A

c. 3 A

d. 4 A

66.



For the a.c. circuit given above, what is the value of I?

a. 1 + j1

b. 1 + j0

c. 2 – j1

d. 0 + j0

67. Match List I (Property of Network) with List II (Relevant Theorem) and select the correct answer using the code given below the Lists:

List I

A. Linearity

B. Structure

C. Equivalent Circuit

D. Bilateral

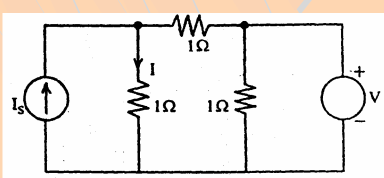
List II

1. Super position Theorem
2. Norton’s Theorem
3. Tellengen’s Theorem
4. Reciprocity Theorem
5. Millman’s Theorem

Codes;

	A	B	C	D
a.	2	5	1	3
b.	1	3	2	4
c.	2	3	1	4
d.	1	5	2	3

68.



In the circuit given above, I = 1A for I_S = 0. What is the value of I for I_S = 2?

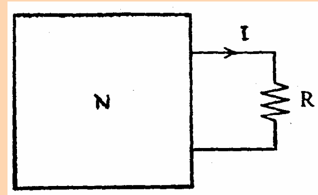
a. 7 A

b. 4 A

c. 3 A

d. 2 A

69.



The black-box, N contains resistors and independent sources. If I = 3A and 1.5A for R = 0 and 2Ω, respectively, then what is the value of I for R = 1Ω?

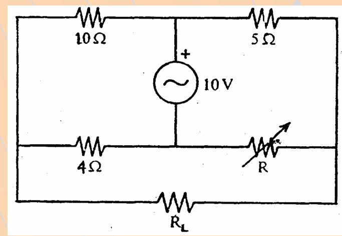
a. 1 A

b. 2 A

c. 3 A

d. 4 A

70.



For the circuit shown above, sthe value of R is adjusted, so as to make the current in R_L equal to zero. What is the

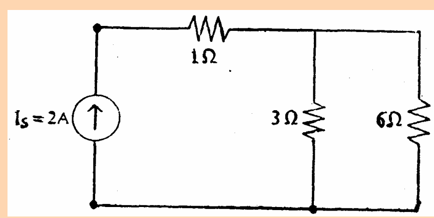
a. 1 Ω

b. 2 Ω

c. 3 Ω

d. 4 Ω

71.



For the circuit shown above, what is the voltage across the current source I_s?

a. 0

b. 2 V

c. 3 V

d. 6 V

72. In an RLC series circuit, if the resistance R and the inductance L are kept constant but capacitance C is decreased, then which one of the following statements is/are correct?

1. Time constant of the circuit is changed.
2. Damping ratio decreases.

3. Natural frequency increases.
4. Maximum overshoot is unaffected.

Select the correct answer using the code given below

a. 1 and 2
b. 2 only
c. 2 and 3
d. 3 and 4

73. From the given list of driving point impedance functions, which one can be realized using R and C elements only

$$Z_1(s)=\frac{(s+8)}{(s+2)(s+6)}$$

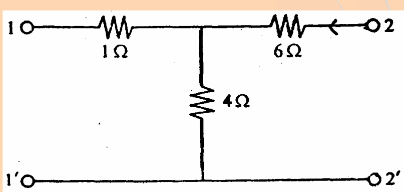
$$Z_2(s)=\frac{(s+2)(s+6)}{(s+4)}$$

$$Z_3(s)=\frac{(s+4)}{(s+2)}$$

$$Z_4(s)=\frac{(s+2)}{(s+1)(s+3)}$$

a. $Z_1(s)$
b. $Z_2(s)$
c. $Z_3(s)$
d. $Z_4(s)$

74.



For the 2-port network shown in the figure given above, what is the value of the parameter h_{21}?

a. 1.5
b. -0.4
c. 0.6
d. -0.5

75. Match List I (Insulating Material) with List II (Application) and select the correct answer using the code given below:

List I

A. Steatite
B. Rutile (Titanium dioxide)
C. Barium titanate
D. Teflon

List II

1. Ceramic capacitor
2. Piezoelectric application
3. Insulating materials for - machine windings
4. High frequency insulator

Codes;

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

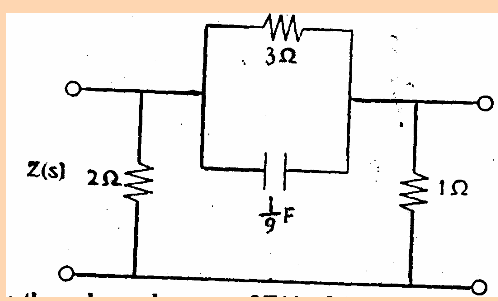
76. A 3-phasedelta-connected symmetrical load consumes P watt of power from a balanced supply. If the same load is connected in star to the same Supply, then what is the power consumption?

a. P/3
b. P
c. $\sqrt{3}$/P
d. 3P

77. A network has a zero at S = -1 and poles at S = - 4 ± j1, the multiplier being unity. If the input is α unit step function, then what is the steady state response?

a. 2∠0°
b. 1∠-45°
c. 3∠90°
d. 0.5∠0°

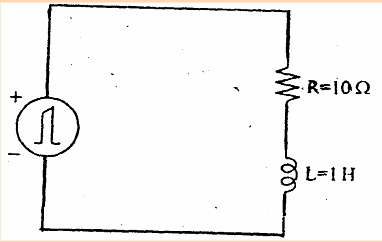
78.



What are the poles and zeroes of Z(s) of the above network?

a. s = - 12, s = - 6
b. s = - 6, s = - 12
c. s = - 3, s = - 6
d. s = - 2, s = - 4

79.



A unit impulse voltage is applied at t = 0 to the R-L circuit shown above while $i(0^-)$ = 1 A. What is the expression for i(t)?

a. e^{-10t}

b. $1.5\ e^{-10t}$

c. $2\ e^{-10t}$

d. $10\ e^{-10t}$

80. A circuit has two parallel branches. In one branch, R and L are connected in series while in the other; R and C are connected in series. If R = $\sqrt{L/C}$, which one of the following is not correct?

a. The circuit is in resonance

b. The two branch currents are in quadrature

c. The circuit has an impedance independent of its frequency

d. The two branch currents are in phase

81. Consider the following statements:

1. Buffer
2. Differentiator
3. Integrator
4. Comparator

Which of the above is/are components in a dual slope integrating type voltmeter?

a. 1, 3 and 4

b. 1 and 2

c. 3 and 4

d. 2 only

82. Beam of electrons in a cathode ray tube eminates because of

a. Second emission

b. Thermionic emission

c. Diffusion

d. Post acceleration

83. Match List I (Magnetic Material) with List II (Order of Susceptibility) and select the correct answer using the code given below the Lists:

List I

A. Diamagnetic

B. Paramagnetic

C. Ferromagnetic

List II

1. $\approx 10^{+5}$

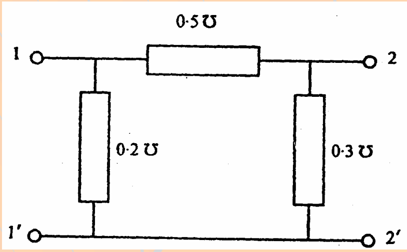
2. $\approx 10^{-5}$

3. $\approx -10^{-5}$

Codes;

	A	B	C
a.	1	3	2
b.	1	2	3
c.	3	2	1
d.	3	1	2

84.



Which one of the following gives the correct short circuit parameter matrix V for the network shown above?

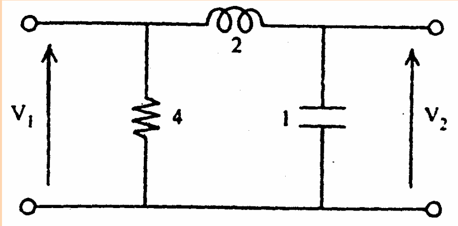
a. $\begin{bmatrix} 0.7 & -0.5 \\ -0.5 & 0.7 \end{bmatrix}$

b. $\begin{bmatrix} 0.7 & -0.5 \\ -0.5 & 0.8 \end{bmatrix}$

c. $\begin{bmatrix} 0.8 & -0.5 \\ -0.5 & 0.7 \end{bmatrix}$

d. $\begin{bmatrix} 0.7 & -0.5 \\ 0.5 & 0.8 \end{bmatrix}$

85.



For the two port network shown above, what is the voltage transfer function $V_2(s)$ / $V_1(s)$?

a. $s/(1+2s^2)$

b. $s/(1+2s)$

c. $1/(1 + 2s^2)$

d. 1/(1 +2s)

86. For a series RLC resonant circuit, what is the total reactance at the lower half power frequency?

a. $\sqrt{2}R\angle 45°$

b. $\sqrt{2}R\angle -45°$

c. R

d. - R

87. Match List I (Insulator) with List II (Application) and select the correct answer using the codes given below the Lists:

List I

A. Mica

B. Polystyrene

C. Porecelain

D. Silicon rubber

List II

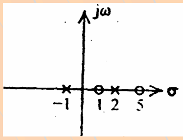
1. Bushings
2. Electric wires and cables
3. Low voltage capacitors
4. Iron
5. Radio cabinets

Codes;

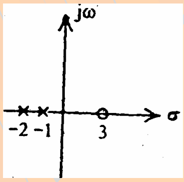
	A	B	C	D
a.	4	5	1	2
b.	2	1	3	4
c.	4	1	3	2
d.	2	5	1	4

88. The current behaviour in a circuit is expressed by: i(t) $2e^{-t} - e^{-5t}\ t \geq 0$. Which one of the following figures shows the pole-zero pattern of I(s)?

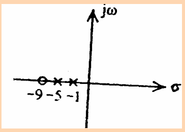
a.



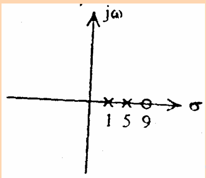
b.



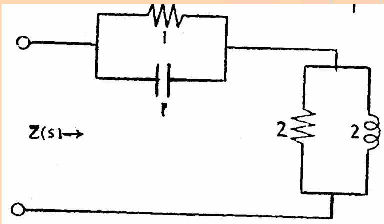
c.



d.



89.



For the circuit shown above, the poles of the driving-point impedance function are at which one of the following locations?

a. A pole at s = -2

b. A pole at s = -1

c. A double pole at s = -1

d. Poles at s = -1 and s -2

90. With the increase in frequency of in electromagnetic wave in free space, how do the velocity V_C and characteristic impedance Z_C change?

a. V_C increases and Z_C decreases

b. V_C decreases and Z_C increases

c. Both V_C and Z_C increase

d. Both V_C and Z_C remain unchanged

91. The E field of a plane electromagnetic wave traveling in a non-magnetic non-conducting medium is given by $\vec{E} = \hat{a}_x 5\cos\left(10^9 t + 30Z\right)$. What is the dielectric constant of the medium?

a. 30

b. 10

c. 9

d. 3

92. In the wave equation

$$\nabla^2 \vec{E} = \mu \in \frac{\partial^2 \vec{E}}{\partial t^2} + \mu\sigma \frac{\partial \vec{E}}{\partial t}$$

Which term is responsible for attenuation of the wave?

a. $\nabla^2 \vec{E}$

b. $\mu \in \frac{\partial^2 \vec{E}}{\partial t^2}$

c. $\mu\sigma \frac{\partial \vec{E}}{\partial t}$

d. All of the above three

93. Metallic copper is a

a. Paramagnetic substance
b. Diamagnetic substance
c. Ferromagnetic substance
d. Ferromagnetic substance

94. The magnetic field required to reduce the residual magnetisation to zero is called

a. Retentivity
b. Coercivity
c. Hysteresis
d. Saturation magnetisation

95. Bohr magneton is unit of

a. Magnetic energy
b. Permanent dipole moment due to spin
c. Polarisability
d. Hysteresis loss

96. Magnetostriction is a phenomenon of

a. Generation of electricity in ferro-magnetic materials
b. Generation of magnetism in conductors
c. Change in permeability of ferro-magnetic materials during magnetisation
d. Change in physical dimensions of ferromagnetic materials during magnetisation

97. Superconductivity is destroyed

a. At high temperature
b. At high magnetic field
c. In presence of magnetic impurities
d. In all the above cases

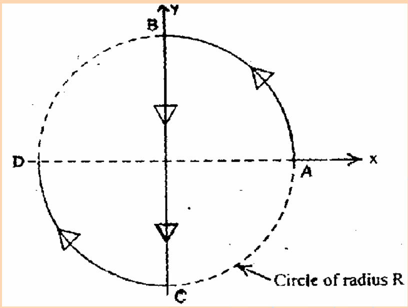
98. Hall Effect can be used

a. To find type of semiconductor (whether p or n type)
b. To find carrier concentration
c. To measure conductivity
d. All of the above

99. For electrostatic fields in charge free atmosphere, which one of the following is correct?

a. $\nabla \times \vec{E} = 0$ and $\nabla . \vec{E} = 0$
b. $\nabla \times \vec{E} \neq 0$ and $\nabla . \vec{E} = 0$
c. $\nabla \times \vec{E} = 0$ and $\nabla . \vec{E} \neq 0$
d. $\nabla \times \vec{E} \neq 0$ and $\nabla . \vec{E} \neq 0$

100.



What is the value of the integral $\int_c \vec{dl}$ along the curve c (c) is the curve ABCD in the direction of the arrow)?

a. $2R\left(\hat{a}_x + \hat{a}_y\right)/\sqrt{2}$
b. $-2R\left(\hat{a}_x + \hat{a}_y\right)/\sqrt{2}$
c. $2R\hat{a}_x$
d. $-2R\hat{a}_y$

101. Consider the following statements:

1. Poisson's equation finds application in vacuum tube and gaseous discharge problems.
2. Gauss's law is useful for determining field and potential distribution about bodies having unsymmetrical geometry.
3. For the propagation of electro-magnetic waves, the time varying electric fields must support time varying magnetic fields.
4. The unit of Poynting's vector is W/m^2.

Which of the statements given above are correct?

a. l, 2 and 3
b. 1, 3 and 4
c. 2, 3 and 4
d. 1, 2 and 4

102. If the electric field established by three point charges Q, 2Q and 3Q exerts a force 3 $\vec{F}$ on 3Q and 2 $\vec{F}$ on 2Q, then what is the force exerted on the point charge Q?

a. $\vec{F}$
b. -$\vec{F}$
c. 5$\vec{F}$
d. -5$\vec{F}$

103. Which one of the following is not the valid expression for magneto static field vector $\vec{B}$?

a. $\vec{B} = \nabla . \vec{A}$

b. $\vec{B} = \nabla \times \vec{A}$

c. $\nabla . \vec{B} = 0$

d. $\nabla \times \vec{B} = \mu_0 \vec{J}$

104. What is the value of standing wave Ratio (SWR) in free space for transmission coefficient $\Gamma = -1/3$?

a. 2/3

b. 0.5

c. 4.0

d. 2.0

105. What is the phase velocity of plane wave in a good conductor?

a. $\sqrt{\pi f \mu \sigma}$

b. $\sqrt{\dfrac{\pi f \sigma}{(\mu \sigma)}}$

c. $\sqrt{\dfrac{\pi f}{(\mu \sigma)}}$

d. $2\sqrt{\dfrac{\pi f}{(\mu \sigma)}}$

106. What is the attenuation constant α for distortion less transmission line?

a. $\alpha = 0$

b. $\alpha = R\sqrt{\dfrac{C}{L}}$

c. $\alpha = R\sqrt{\dfrac{L}{C}}$

d. $\alpha = \sqrt{\dfrac{RL}{C}}$

107. A 50 Ω distortion less transmission line has a capacitance of 10^{-10} f/m. What is the inductance per meter?

a. 0.25 μH

b. 500 μH

c. 5000 μH

d. 50 μH

108. Which one of the following is the Poisson's equation for a linear and isotropic but inhomogeneous medium?

a. $\nabla^2 V = -\rho / \in$

b. $\bar{\nabla}.(\in \nabla V) = -\rho$

c. $\bar{\nabla}.\bar{\nabla}(\in V) = -\rho$

d. $\nabla^2 V = -\rho / \in$

109. The open circuit and short circuit impedances of a line are 100 Ω each. What is the characteristic impedance of the line ?

a. $100\sqrt{2}\ \Omega$

b. 100 Ω

c. $100/\sqrt{2}\ \Omega$

d. 50 Ω

110. A load impedance of (75 - j50) is connected to a transmission line of characteristic impedance Z_0 = 75Ω. The best method of matching comprises

a. A short circuit stub at load

b. A short circuit stub at some specific distance from load

c. An open stub at load

d. Two short circuited stubs at specific distances from load

111. When a lossless transmission line is terminated by a resistance equal to surge impedance, then what is value of the reflection coefficient?

a. 1

b. -1

c. 0

d. 0.5

112. The instantaneous electric field of a plane wave propagating in z-direction is

$$\underline{E}(t) = \left[\hat{a}_x E_1 \cos \omega t - \hat{a}_y E_2 \sin \omega t\right] e^{-jkz}$$

This wave is

a. Linearly polarized

b. Elliptically polarized

c. Right hand circularly polarized

d. Left hand circularly polarized

113. Assertion (A): For a lossy transmission line, the voltage standing wave ratio (VSWR) is higher near the load end than that near the source end.

Reason (R): In the presence of losses, the propagation constant of the line becomes a complex quantity.

a. Both A and R are individually 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

114. Assertion (A): The flux densities used in PMMC instruments vary from 0.1T to 1.0T.

Reason (R): The power requirement for PMMC movement to give full scale deflection is small ranging from 25μW to 200 μW.

a. Both A and R are individually 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

115. Assertion (A): The variation in gain of the system does not alter the phase angle plot in the Bode diagram.

Reason (R): The phase margin of the system is not affected by the variation in gain of the system.

a. Both A and R are individually 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

116. Assertion (A): Signal flow graphs can be used for block diagram reduction of linear control system.

Reason (R): Signal flow graph is a graphical representation for the variables representing the outputs of the various blocks of the control system.

a. Both A and R are individually 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

117. Assertion (A): The PMMC type of indicating instruments are always critically damped.

Reason (R): A critically damped system directly moves to its steady state without oscillation.

a. Both A and R are individually 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

118. Assertion (A): For a control system having synchro pair as error detector dc amplifier as control amplifier, a phase sensitive detector is required to demodulate in place of ordinary diode detector.

Reason (R): Synchro output is a suppressed carrier amplitude modulated signal which cannot be demodulated by ordinary diode detector.

a. Both A and R are individually 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

119. Assertion (A): Skin depth is the depth by which electromagnetic wave has been increased to 37% of its original value.

Reason (R): The depth of penetration of wave in a lossy dielectric increases with increasing wavelength.

a. Both A and R are individually 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

120. Assertion (A): An insulator has a high value of resistivity, and with increasing temperature the value of its resistivity decreases exponentially.

Reason (R): With increasing temperature, the value of the energy band gap decreases.

a. Both A and R are individually 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