1. Consider the following statements:

The output of a linear circuit, driven with a sine wave at a frequency f, is itself a sine wave

1. at the same frequency

2. with chance of changed amplitude

3. with chances of changed amplitude and phase

Which of the above statements is/are correct?

(A) 1 and 2 (B) 1 only

(C) 1 and 3 (D) 2 only

Key: (C)

Sol: For a linear system, if the input is a sinusoidal signal then the output is also a sinusoidal signal with same frequency but the amplitude and phase of the output may varie.

2. Consider the following statements:

The main contribution to photoconduction is by

1. the generation of electron and hole pair by a photon

2. a donor electron jumping into the conduction band because of a photon's energy

3. a valence electron jumping into an acceptor state because of a photon's energy

Which of the above statements is/are correct?

(A) 1 only (B) 2 only

(C) 3 only (D) 1, 2 and 3

Key: (A)

Sol: In photoconduction, due to illumination covalent bonds will be broken and electron and hole pair is generated. Thus only (1) is correct.

3. Thermal runaway is not possible in FET because as the temperature of the FET increases

(A) Mobility decreases

(B) trans-conductance increases

(C) drain current increases

(D) trans-conductance decreases

Key: (A)

Sol: As the temperature of FET increases, mobility decreases.

4. For JFET, the drain current I_D is

(A) $I_{DSS}\left(1-\frac{V_{GS}}{V_P}\right)^{\frac{1}{2}}$

(B) $I_{DSS}\left(1-\frac{V_{GS}}{V_p}\right)$

(C) $I_{DSS}\left(1-\frac{V_{GS}}{V_P}\right)^{\frac{3}{2}}$

(D) $I_{DSS}\left(1-\frac{V_{GS}}{V_P}\right)^{2}$

Key: (D)

Sol: For JFET, the drain correct is

$$I_D = I_{Dss}\left[1-\frac{V_{Gs}}{V_P}\right]^2$$

(Shockley's equation)

5. For n-channel depletion MOSFET, the highest trans-conductance gain for small signal is at

(A) $V_{GS}=0V$ (B) $V_{GS}=V_p$

(C) $V_{GS}=|V_p|$ (D) $V_{GS}=-V_p$

Key: (A)

Sol: For n-channel deletion MOSFET, the trans-conductance formulae is

$$g_m = g_{mo}\left[1-\frac{V_{Gs}}{V_P}\right]$$

Where g_m is highest trans-conductance at $V_{GS}=0V$

6. The n-p-n transistor made of silicon has a DC base bias voltage 15 V and an input base resistor $150k\Omega$. Then the value of the base current into the transistor is

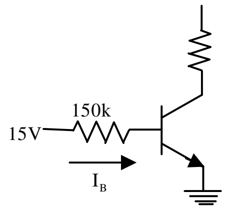
(A) $0.953\mu A$ (B) $9.53\mu A$

(C) $95.3\mu A$ (D) $953\mu A$

Key: (C)

Sol: $V_B = 15V; R_B = 150k;$

$$I_B = \frac{15-0.7}{150\times10^3} = 95.3\mu A$$



7. A signal may have frequency components which lie in the range of 0.001 Hz to 10 Hz. Which one of the following types of couplings should be chosen in a multistage amplifier designed to amplify the signal?

(A) Capacitor coupling

(B) Direct coupling

(C) Transformer coupling

(D) Double-tuned transformer coupling

Key: (B)

Sol: For low frequency signal (0.001 Hz to 10 Hz), direct coupling is used in multistage amplifier.

8. If an input impedance of op-amp is finite, then which one of the following statements related to virtual ground is correct?

(A) Virtual ground condition may exist.

(B) Virtual ground condition cannot exist.

(C) In case of op-amp, virtual ground condition always exists.

(D) Cannot make a valid declaration.

Key: (B)

Sol: If input impedance of Op- amplifier is finite (for non ideal Op-amp), virtual ground condition cannot exist.

9. Hysteresis is desirable in a Schmitt trigger because

(A) energy is to be stored/discharged in parasitic capacitances

(B) effects of temperature variations would be compensated

(C) devices in the circuit should be allowed time for saturation and de-saturation

(D) it would prevent noise from causing false triggering

Key: (D)

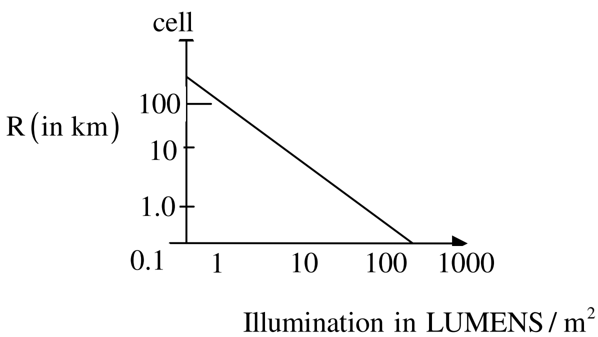
10. In a photoconductive cell, the resistance of the semiconductor material varies with intensity of incident light

(A) directly (B) inversely

(C) exponentially (D) logarithmically

Key: (A)

Sol: Illumination characteristics of a typical photo conductive cell



11. In graded index multimode optical fiber the refractive index of the core is

(A) uniform across its radial distance, except for the cladding

(B) maximum at the fiber axis and decreases stepwise towards the cladding

(C) maximum at the fiber axis and decreases gradually towards the cladding

(D) maximum at the fiber axis and increases stepwise towards the cladding

Key: (C)

Sol: Inside the optical fiber, at core negative index in high and it decreases gradually toward cladding.
In stop-index, it decrease step wise.

12. Consider the following factors:
1. Number of turns of the coil
2. Length of the coil
3. Area of cross-section of the coil
4. Permeability of the core
On which of the above factors does inductance depend?
(A) 1, 2 and 3 only (B) 1, 3 and 4 only
(C) 1, 2, 3 and 4 (D) 2 and 4 only

Key: (C)

Sol: $L = \frac{\mu_0 \mu_r N^2 A}{\ell}$

13. A mathematical expression for 50 Hz sinusoidal voltage of peak value 80 V will be
(A) $v = 50\sin 314t$ (B) $v = 50\sin 80t$
(C) $v = 80\sin 314t$ (D) $v = 80\sin 50t$

Key: (C)

Sol: $v(t) = V_m \sin(2\pi f_c t)$
$f_c \rightarrow$ frequency
$V_m \rightarrow$ peak value
$v(t) = 80\sin(2\times 3.14\times 50\times t)$
$= 80\sin(314t)$

14. Consider the following statements:
1. Fleming's rule is used where induced e.m.f. is due to flux cutting.
2. Lenz's law is used when the induced e.m.f. is due to change in flux linkages.
3. Lenz's law is a direct consequence of the law of conservation of energy.
Which of the above statements are correct?
(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

15. A conductor of length 1 m moves at right angles to a uniform magnetic field of flux density 2 wb/m^2 with a velocity of 50 m/s. What is the value of the induced e.m.f. when the conductor moves at a angel of 30° to the direction of the field?
(A) 75V (B) 50V
(C) 25V (D) 12.5V

Key: (B)

Sol: Given
$\ell = 1\text{m};\ B = 2\text{wb/m}^2,\ v = 50\text{m/s},\ \theta = 30^0$
$e = B\ell v\sin\theta$
$= 2\times 1\times 50\times \sin 30$
$e = 100\times \frac{1}{2} = 50\text{V}$

16. The total flux at the end of a long bar magnet is 500μ Wb. The end of the bar magnet is withdrawn through a 1000-turn coil in $\frac{1}{10}$ second. The e.m.f generated across the terminals of the coil is
(A) 5V (B) 10V (C) 25V (D)50V

Key: (A)

Sol: $d\phi = 500\mu\text{wb}, N = 1000,\ dt = \frac{1}{10}\text{ sec}$
EMF generated,
$E = N.\frac{d\phi}{dt}$
$= 1000\times \frac{500\times 10^{-6}}{\frac{1}{10}}$
$E = 5\text{V}$

17. The slip of a 400 V, 3-phase, 4-pole, 50 Hz machine running at 1440 r.p.m. is
(A) 6% (B) 5% (C) 4% (D) 3%

Key: (C)

Sol: Given
$p = 4,\ f = 50\text{Hz},\ N_r = 1440\text{rpm}$

$$\text{slip, } s=\frac{N_s-N_r}{N_s}\times 100$$

Synchronous speed,

$$N_s=\frac{120f}{p}=\frac{120\times 50}{4}=1500 \text{ rpm}$$

$$\text{Slip, } s=\frac{1500-1440}{1500}\times 100$$

$$=0.04\times 100$$

$$=4\%$$

18. A 500 HP, 440 V, 3-phase, 50 Hz induction motor runs at 950 r.p.m. when on full load with a synchronous speed of 1000 r.p.m. For this condition, the frequency of the rotor current will be

(A) 4.0 Hz (B) 3.5 Hz

(C) 2.5 Hz (D) 2.0 Hz

Key: **(C)**

Sol: 500Hp, 440V, $3-\phi$, 50Hz induction motor.

$N_r=950$ rpm, $N_s=1000$ rpm

Frequency of rotor current,

$$f_r=s.f$$

$$s=\text{slip}=\frac{N_s-N_r}{N_s}\times 100$$

$$=\frac{1000-950}{950}$$

$$=0.05$$

$$f_r=0.05\times 50=2.5\text{Hz}$$

19. By adding resistance in the rotor circuit of a slip ring induction motor, the starting current

(A) as well as torque reduce

(B) as well as torque increase

(C) reduces but the starting torque increases

(D) increases but the starting torque decreases

Key: **(C)**

Sol: By increasing the rotor resistance, it not only reduces the stator current, but also the rotor current too. This implies that starting current of motor is reduced and starting torque is increased due to improvement in power factor.

20. Consider the following statements with regards to an induction motor:

1. Maximum torque is independent of rotor resistance.
2. Starting torque is maximum when rotor resistance equals rotor reactance.
3. Torque is very sensitive to any changes in supply voltage.

Which of the above statements are correct?

(A) 1 and 2 only (B) 1 and 3 only

(C) 2 and 3 only (D) 1, 2 and 3

Key: **(D)**

Sol: We have maximum torque equation as:

$$T_{max}=\frac{3}{2\pi N_s}.\frac{E_2^2}{2X_2}N-m$$

So from the above equation, we can infer that maximum torque is independent of resistance.

Starting torque is maximum (i.e at s = 1) when rotor resistance is equal to rotor reactance i.e., $R_2=X_2$ and

Now, E_2 α supply voltage V

$$\therefore T_{st}=\frac{KV^2R_2}{R_2^2+X_2^2}$$

$$\therefore\ T_{st}\ \alpha\ V$$

The torque is very sensitive to any changes in supply voltage. Hence all the given 3 statements are correct.

21. A transformer has 2% resistance and 5% reactance. What is its voltage regulation at full load with 0.8 p.f. lagging?

(A) 5.3% (B) 4.6%

(C) 0.53% (D) 0.46%

Key: **(B)**

Sol: Voltage regulation for lagging power factor loads is

$$\%V = \%R\cos\phi + \%X\sin\phi$$

$$\%R = 2\%; \%X = 5\%; \cos\phi = 0.8;$$

$$\sin\phi = \sin\left(\cos^{-1}(0.8)\right) = 0.6$$

$$\%V = 2\times0.8 + 5\times0.6 = 4.6\%$$

22. A voltage is generated across a piezoelectric material, 0.5 cm thick, subjected to an impact of 5 N/m^2. The voltage coefficient of the material is $23\,kV-m/N$. The magnitude of the voltage generated will be

(A) 2300 V (B) 1650 V

(C) 1150 V (D) 575 V

Key: **(D)**

Sol: $E = gF$

$$E = \frac{V}{d}$$

$$V = gFd$$

Where g is Coefficient = 23 kV-m/N

F is force = $5N/m^2$

D is thickness = 0.5 cm = $0.5\times10^{-2}\,m$

$$V = 23\times10^{3}\times5\times0.5\times10^{-2} = 575V$$

23. The 'residual resistivity' of a metal is

(A) due to lattice vibrations at high temperature

(B) due to photon scattering at high temperature

(C) temperature-dependent

(D) temperature-independent

Key: **(D)**

24. Electrical conductivity, thermal conductivity and magnetic properties of ceramic material are

(A) very high all the time

(B) very low all the time

(C) dependent on the material

(D) ascertainable, instance to instance

Key: **(D)**

Sol: In ceramic materials all properties are constant till particular temperature after that it will change.

25. Laminated insulation, coated with varnish, is a staple adoption in transformer assemblage in order to

(A) reduce the reluctance of the magnetic path

(B) minimize losses due to eddy currents

(C) increase the reluctance of the magnetic path

(D) increase the effect of eddy current

Key: **(B)**

Sol: Eddy current loss depends on thickness.

26. When a ferromagnetic substance is magnetized there are marginal diminutions in its linear dimensions. This phenomenon is called

(A) hysteresis

(B) magnetostriction

(C) diamagnetism

(D) dipolar relaxation

Key: **(B)**

27. When the working temperature becomes more than the curie temperature, a ferromagnetic material becomes a

(A) diamagnetic material

(B) paramagnetic material

(C) ferromagnetic material

(D) Mu-material

Key: **(B)**

28. Compared to other materials, a material with a wider hysteresis loop has

(A) lower permeability, higher retentivity and higher coercivity
(B) higher permeability, lower retentivity and higher coercivity
(C) lower permeability, higher retentivity and lower reluctance
(D) lower permeability, lower retentivity and lower residual magnetism

Key: **(A)**

Sol: Wider hysteresis will have more losses.

29. Which of the following material is used in light-emitting diodes?
(A) Gallium arsenide sulphate
(B) Gallium arsenide phosphide
(C) Gallium chromate phosphide
(D) Gallium phosphide sulphate

Key: **(B)**

Sol: In Light emitting materials we use compound semiconductors (combination of III rd and V group) which are direct band gap materials.

30. Consider the following methods in nano particle synthesis:
1. Bottom –up **2.** Top-down
3. side-by-side

Which of these methods is/are slow and does/do not conduce to large-scale production?

(A) 1 only (B) 2 only
(C) 3 only (D) 1, 2 and3

Key: **(A)**

Sol: Top-Bottom is slow and not suitable for large scale production.

31. Consider the following statements:
1. Type-I superconductors undergo abrupt transition to the normal state above a critical magnetic field.
2. Type-II superconductors are highly technologically useful super conductors because the incidence of a second critical field in them is useful in the preparation of high field electromagnets.

Which of the above statements is/are correct?

(A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: **(C)**

Sol: For electromagnets there should be residual magnetism. In TYPE –II residual magnetism exists for all cases.

32. Consider the following statements:
1. Metal conductors have more R at higher temperatures.
2. Tungsten can be used as a resistance wire.
3. A superconductive material is one which has practically zero resistance.

Which of the above statements are correct?

(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: **(B)**

33. Consider the following statements regarding precision in measurements of a quantity:
1. Precision is the measure of the spread of the incident errors.
2. Precision is independent of the realizable correctness of the measurement
3. Precision is usually described in terms of number of digits used in the measurement by a digital instrument.

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1 and 2 only
(C) 1 and 3 only (D) 2 and 3 only

Key: (A)

34. Consider the following statements in connection with deflection-type and null-type instruments:

1. Null-type instruments are more accurate than the deflection-type ones.

2. Null-type of instrument can be highly sensitive compared to a deflection-type instrument.

3. Under dynamic conditions, null-type instruments are less preferred to deflection-type instruments.

4. Response is faster in null-type instruments as compared to deflection-type instruments.

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1, 2 and 4

(C) 1, 3 and 4 (D) 2, 3 and 4

Key: (A)

Sol: Null-type instruments are preferable because of its superior accuracy. Null-type instruments are more sensitive then deflection type.

35. A voltmeter having a sensitivity of $1000\Omega/V$ reads 100 V on its 150 V scale when connected across a resistor of unidentified specifications in series with a milliammeter. When the milliammeter reads 5 mA, the error due to the loading effect of the voltmeter will be nearly

(A) 13% (B) 18%

(C) 23% (D) 33%

Key: (A)

Sol: $\text{Sensitivity} = 1000\Omega / V$, full scale = 150 V

Voltmeter resistance

$(R_v) = 1000\Omega / V \times 150V = 150k\Omega$

Voltmeter current

$$(I_v) = \frac{100}{150k\Omega} = 0.67mA$$

$$I_m = I - I_v$$

$$= 5mA - 0.67mA$$

$$= 4.33 \text{ mA}$$

$$R = \frac{100V}{4.33mA} = 23.09k\Omega$$

$$R_m = \frac{100V}{5mA} = 20k\Omega$$

Error due to loading effect of voltmeter is

$$= \frac{20 - 23.09}{23.09} \times 100$$

$$= -13.38\%$$

36. Consider the following statements:

Sphere gap method of voltage measurement is used

1. for measuring r.m.s value of a high voltage

2. for measuring peak value of a high voltage

3. as the standard for calibration purposes

Which of the above statements are correct?

(A) 1 and 2 only (B) 2 and 3 only

(C) 1 and 3 only (D) 1, 2 and 3

Key: (B)

37. High frequency (in the MHz range) and low amplitude (in the mV range) signals are best measured using

(A) VTVM with a high impedance probe

(B) CRO

(C) moving-iron instrument

(D) digital multimeter

Key: (B)

38. In scintillation coating applications, shields of which material are generally placed around the photomultiplier tube to

overcome interference effects of electrons deflected from their normal path?
(A) Ferromagnetic
(B) Mu-metal magnetic
(C) Electromagnetic
(D) Dielectric

Key: **(C)**

39. A PMMC instrument if connected directly to measure alternating current, it indicates
(A) the actual value of the subject AC quantity
(B) zero reading
(C) $\frac{1}{\sqrt{2}}$ of the scale value where the pointer rests
(D) $\frac{\sqrt{3}}{2}$ of the scale value where the pointer rests

Key: **(B)**

Sol: Average torque produced is zero for AC supply. Hence, no deflection is produced.

40. Which of the following are measured by using a vector voltmeter?
1. Amplifier gain and phase shift
2. Filler transfer function
3. Complex insertion loss

Select the correct answer using the code given below.
(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: **(D)**

41. In a transistor, the base current and collector current are, respectively, 60μA and 1.75 mA. The value of α is nearly
(A) 0.91 (B) 0.97 (C) 1.3 (D) 1.7

Key: **(B)**

Sol: Given $I_B = 60\mu A; I_C = 1.75\text{ mA}$

$$\beta = \frac{I_C}{I_B} = \frac{1.75\times10^{-3}}{60\times10^{-6}} = 29.17$$

$$\alpha = \frac{\beta}{1+\beta} = \frac{29.17}{1+29.17} = 0.97$$

42. A liquid flows through a pipe of 100 mm diameter at a velocity of 1 m/s. If the diameter is guaranteed within +1% and the velocity is known to be within ±3% of measured value, the limiting error for the rate of flow is
(A) ±1% (B) ±2%
(C) ±3% (D) ±5%

Key: **(D)**

Sol: $D = 100\text{ mm}, V = 1\text{m/s}$

With generated errors;

$D = 100\text{mm} + 1\%; V = 1 \pm 3\%$

Rate of flow $(Q) = V \times A\ m^3/\text{sec}$

$$Q = V\times\frac{\pi}{4}D^2$$

$$\ln Q = \ln V + \ln\frac{\pi}{4} + 2\ln D$$

$$\frac{1}{Q} = \frac{1}{V}\frac{dV}{dQ} + 0 + \frac{2}{D}\cdot\frac{dD}{dQ}$$

$$\frac{\Delta Q}{Q}\times100 = \frac{\Delta V}{V}\times100 + 2\frac{\Delta D}{D}\times100$$

$$= 3\% + 2\times1\% = \pm5\%$$

43. A $3\frac{1}{2}$ digit digital voltmeter is accurate to $\pm0.5\%$ of reading ±2 digits. What is the percentage error, when the voltmeter reads 0.10 V on its 10 V range?
(A) 0.025% (B) 0.25%
(C) 2.05% (D) 20.5%

Key: **(D)**

Sol: Reading on 10V range = 0.1 V

Error $= (\pm0.5\%\text{ of reading} \pm 2\text{ digits})$

Resolution of $3\frac{1}{2}$ DVM in 20 V range

$$= \frac{20}{2\times 10^3} = 0.01\text{V}$$

So error

$$= \pm\left[\frac{0.5}{100}\times 0.1\text{V} + (2\times 0.01)\right] = \pm(2.0205\text{V})$$

Therefore error in reading

$$= \pm\frac{0.0205\text{V}}{0.1\text{V}}\times 100$$

$$= \pm 20.5\%$$

44. The simplest and most common method of reducing any 'effect of inductive coupling' between measurement and power circuits is achieved by using

(A) a screen around the entire measurement circuit

(B) twisted pairs of cable

(C) capacitor (s) to be connected at the power circuit

(D) capacitor(s) to be connected at the measurement circuit

Key: **(B)**

45. A capacitance transducer uses two quartz diaphragms of area $750\,\text{mm}^2$ separated by a distance 3.5 mm. The capacitance is 370 pF. When a pressure of $900\,\text{KN/m}^2$ is applied, the deflection is 0.6 mm. The capacitance at this pressure would be

(A) 619 pF (B) 447 pF

(C) 325 pF (D) 275 pF

Key: **(B)**

Sol: Capacitance,

$$C = \frac{\varepsilon A}{d}$$

$$\text{i.e,} C \propto \frac{1}{d}$$

$$\frac{C_1}{C_2} = \frac{d_2}{d_1}$$

$$C_2 = \frac{d_2}{d_1}\times C_1 = \frac{3.5}{(3.5-0.6)}\times 370\,\text{pF} = 447\,\text{pF}$$

46. Consider the following statements regarding Time-Division Multiplexing (TDM):

1. The information from different measuring points is transmitted serially on the same communication channel.

2. It involves transmission of data samples rather than continuous data transmission.

3. It is especially useful when telemetering fast-changing, high bandwidth data.

Which of the above statements are valid in respect to TDM?

(A) 1, 2 and 3 (B) 1 and 3 only

(C) 1 and 2 only (D) 2 and 3 only

Key: **(A)**

Sol: All are the benefits of TDM.

47. Consider the following regarding essential functional operations of a digital data acquisition system:

1. Handling of analog signals

2. Converting the data to digital form and handling it

3. Making the measurement

4. Internal programming and telemetry

Which of the above are valid in the stated context?

(A) 1, 2, 3 and 4 (B) 1, 3 and 4 only

(C) 1, 2 and 3 only (D) 2 and 4 only

Key: (A)

48. A low resistance LDR of 20Ω, operated at a certain intensity of light, is to be protected through a series resistance in such a way that up to 12 mA of current is to flow at a supply voltage of 10 V. What is the nearest value of the protective resistance?

(A) 873Ω (B) 813Ω

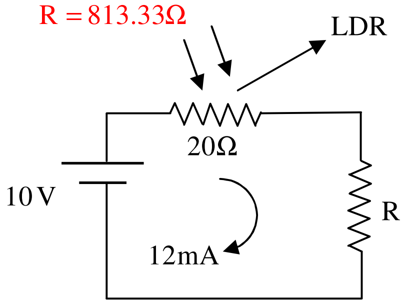
(C) 273Ω (D) 81Ω

Key: (B)

Sol: From the circuit,

$10 - 12mA(20+R)$

$R = 813.33\Omega$

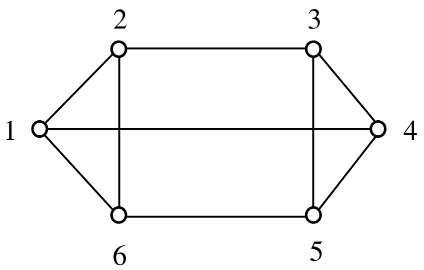


(OR)

$R_{series} = \frac{10}{12mA} = 833\Omega$

$= R_{protected} + 20 = \ R_{protected} = 813\Omega$

49. Consider the following with regards to graph as shown in the figure given below:



1. Regular graph

2. Connected graph

3. Complete graph

4. Non-regular graph

Which of the above are correct?

(A) 1 and 4 (B) 3 and 4

(C) 2 and 3 (D) 1 and 2

Key: (D)

Sol: It is a 3-regular graph (degree of every vertex is 3) and also connected. [In a connected graph there will be at least one path between every pair of vertices]. It is not complete graph because in a complete graph every vertex must be adjacent to all other vertices as it must be connected.

For a connected graph, we can always have atleast one tree (because in the graph every pair of vertices has atleast one path between the, because it is already connected) for a connected graph, tree is nothing but the subgraph which contains all vertices of the graph and it is a tree. This is infact called as the spanning tree of the given graph. And there can be more than one spanning tree for a given connected graph, in this case given has cycles.

50. A network in which all the elements are physically separable is called a

(A) distributed network

(B) lumped network

(C) passive network

(D) reactive network

Key: (B)

51. Three identical impedances are first connected in delta across a 3-phase balanced supply. If the same impedances are now connected in star across same supply, then

(A) the phase current will be one-third

(B) the line current will be one-third

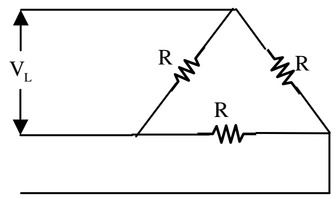
(C) the power consumed will be one-third

(D) the power consumed will be halved

Key: **(C)**

Sol:

Δ – Connection



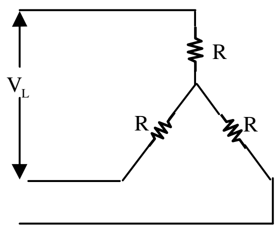
Say Z = R

For Δ-Connection

$$V_L = V_{ph}$$

$$P_\Delta = \frac{V_{ph}^2}{R} = \frac{V_L^2}{R}$$

Y – Connection



For Y - Connection

$$V_{ph} = \frac{V_L}{\sqrt{3}}$$

$$P_Y = \frac{V_{ph}^2}{R} = \frac{V_L^2}{3R}$$

$$\boxed{P_Y = \frac{P_\Delta}{3}}$$

(Or)

Power consumed (in delta) $= 3.\frac{V^2}{R}$

In star connection, $V \to V/\sqrt{3}$

Power consumed (in star) $= 3\frac{\left(V/\sqrt{3}\right)^2}{R}$

$$= \frac{V^2}{R}$$

$\Rightarrow P_{star}$ will be $\frac{1}{3}$ of P_{delta}

52. Consider the following statements regarding trees:

1. A tree contains all the nodes of the graph.
2. A tree shall contain any one of the loops.
3. Every connected graph has at least one tree.

Which of the above statements are correct?

(A) 1 and 2 only (B) 1 and 3 only

(C) 2 and 3 only (D) 1, 2 and 3

Key: **(B)**

Sol: A tree is nothing but a connected acyclic graph which means there should not be any cycle in the tree and between every pair of vertices there should be a path.

53. A voltage $v(t) = 173\sin(314t + 10°)$ is applied to a circuit. It causes a current flow described by $i(t) = 14.14\sin(314t - 20°)$

The average power delivered is nearly

(A) 2500 W (B) 2167 W

(C) 1500 W (D) 1060 W

Key: **(D)**

Sol: $P_{avg} = \frac{V_m I_m}{2}.\cos\theta$

$$= \frac{14.14 \times 173}{2}\cos 30$$

$$= 1060\text{W}.$$

54. Consider the following statements with respect to a parallel R-L-C circuit:

1. The bandwidth of the circuit decreases if R is increased.

2. The bandwidth of the circuit remains same if L is increased.

3. At resonance, input impedance is a real quantity.

4. At resonance, the magnitude of the input impedance attains its minimum value.

Which of the above statements are correct?

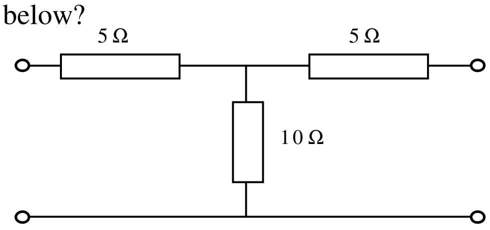
(A) 1, 2 and 4 (B) 1, 3 and 4

(C) 2, 3 and 4 (D) 1, 2 and 3

Key: **(D)**

Sol:
- $BW = \frac{1}{RC}$
- 'L' does not have any influence on BW in parallel RLC
- at resonance, Z = R, Real quantity

55. What is the admittance matrix for a two-port network shown in the figure given below?



(A) $\begin{bmatrix} 15 & 5 \\ 5 & 15 \end{bmatrix}$ (B) $\frac{1}{200}\begin{bmatrix} 15 & -5 \\ -5 & 15 \end{bmatrix}$

(C) $\begin{bmatrix} 5 & 15 \\ 15 & 5 \end{bmatrix}$ (D) $\frac{1}{200}\begin{bmatrix} 200 & 5 \\ 15 & 20 \end{bmatrix}$

Key: **(*)**

Sol: admittance matrix

$= [\text{impedance matrix}]^{-1}$

Impedance matrix $= \begin{bmatrix} 15 & 10 \\ 10 & 15 \end{bmatrix}$

Admittance matrix

$= \frac{1}{125}\begin{bmatrix} 15 & -10 \\ -10 & 15 \end{bmatrix}$

(None of the option matching).

56. A two-port network is characterized by

$I_1 = 3V_1 + 4V_2$

$6I_2 = 2V_1 - 4V_2$

Its A, B, C and D parameters are, respectively

(A) 2, 3, 6 and 9 (B) 2, -3, 10 and -9

(C) 3, 2, -9 and 6 (D) 3, -2, 9 and -6

Key: **(B)**

Sol: $I_1 = 3V_1 + 4V_2 \Rightarrow I_1 = 9I_2 + 10V_2 = CV_2 - DI_2$

$6I_2 = 2V_1 - 4V_2 \Rightarrow V_1 = \frac{6I_2 + 4V_2}{2} = 3I_2 + 2V_2 = AV_2 - BI_2$

$C = 10 \quad A = 2$

$\Rightarrow \quad D = -9 \quad B = -3.$

57. A unit-step voltage is applied at t = 0 to a series R-L circuit with zero initial condition. Then

(A) it is possible for the current to be oscillatory

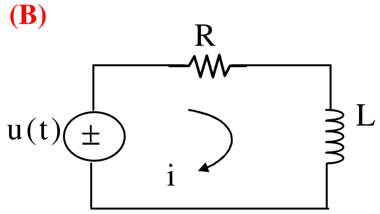
(B) the voltage across the resistor at $t = 0^+$ is zero

(C) the voltage across the resistor at $t = 0^-$ is zero

(D) the resistor current eventually falls to zero

Key: **(B)**

Sol:



$$i(t)=i(\infty)+\left(i(0)-i(\infty)\right)e^{\frac{-Rt}{L}}$$

$$=\frac{1}{R}+\left(0-\frac{1}{R}\right)e^{\frac{-Rt}{L}}$$

$$=\frac{1}{R}\left(1-e^{\frac{-R}{L}t}\right)$$

$$i(\infty)=\frac{1}{R}$$

$$V(\infty)=0.$$

at $T = 0^+$ inductor is open circuit hence

$V_2 = 1V, V_R(0^+) = 0V$.

58. One of the basic characteristics of any steady-state sinusoidal response of a linear R-L-C circuit with constant R, L and C values is

(A) the output remains sinusoidal with its frequency being the same as that of the source

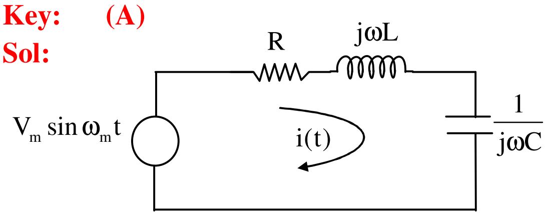
(B) the output remains sinusoidal with its frequency differing form that of the source

(C) the output amplitude equals the source amplitude

(D) the phase angle difference between the source and the output is always zero

Key: (A)

Sol:



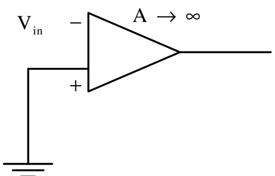
$$i(t)=\frac{V_m \sin \omega_m t}{R+j\left(\omega L-\frac{1}{\omega C}\right)}$$

$$i(t)=\frac{V_m}{\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}}\sin\left(\omega_m t-\tan^{-1}\right)\left(\frac{\omega L-\frac{1}{\omega C}}{R}\right)$$

(Or)

For an linear RLC network steady state sinusoidal response follows the input with the same frequency as input sinusoid.

59. If the input (V_{in}) to the circuit is a since wave, the output will be



(A) half-wave rectified sine wave

(B) full-wave rectified sine wave

(C) triangular wave

(D) square wave

Key: (D)

60. Which one of the following analog-to Digital converters (ADC) does not use a DAC?

(A) Digital ramp ADC

(B) Successive approximation ADC

(C) Single-slope ADC

(D) Counting ADC

Key: (C)

Sol: Single – slope ADC does not use a DAC.

61. A 12-bit A/D converter has a full- scale analog input of 5 V. Its resolution is

(A) 1.22 mV (B) 2.44 mV

(C) 3.66 mV (D) 4.88 mV

Key: (A)

Sol: Resolution $=\frac{\text{Full scale input}}{\text{No. of quantization level}}=\frac{5}{2^{12}}$

$$=\frac{5}{4096}=1.22\,mV$$

62. Which of the following circuits converts/ convert a binary number on the input to a one-hot encoding at the output?

1. 3-to-8 binary decoder

2. 8-to-3 binary decoder
3. Comparator

Select the correct answer using the code given below.

(A) 1 only (B) 2 only
(C) 3 only (D) 1, 2 and 3

Key: (A)

Sol: 3×8 binary decoder
One hot encoding means only those with a single high (1) bit and all other low (0).

63. The simplification in minimal sum of product (SOP) of

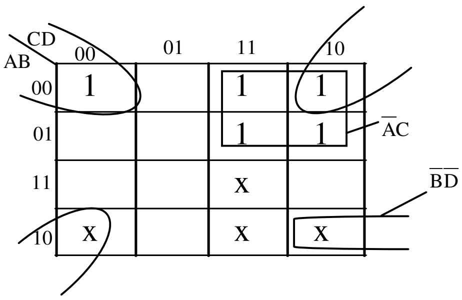
$$Y = F(A,B,C,D)$$
$$= \Sigma_m (0,2,3,6,7) + \Sigma_d (8,10,11,15)$$

Using K-maps is

(A) $Y = AC + B\overline{D}$ (B) $Y = A\overline{C} + B\overline{D}$
(C) $Y = \overline{A}\,\overline{C} + \overline{B}D$ (D) $Y = \overline{A}C + \overline{B}\,\overline{D}$

Key: (D)

Sol:



$Y = \overline{A}C + \overline{B}\,\overline{D}$

64. A circuit outputs a digit in the form of 4 bits.0 is represented by 0000, 1 is represented by 0001, … 9 by 1001. A combinational circuit is to be designed which takes these 4 bits as input and output as 1, if the digit is ≥ 5, and 0 otherwise. If only AND, OR and NOT gates may be used, what is the minimum number of gates required?

(A) 4 (B) 3 (C) 2 (D) 1

Key: (B)

Sol:

Inputs A	B	C	D	Outputs F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1

AB \ CD	00	01	11	10
00	0	0	0	0
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

$F = A + B.D + BC$
$AND - gates = 2$
$OR - gate = 1$

65. How many 3-to-8 line decoders with and enabler input are needed to construct a 6-to-64 line decoder without using any other logic gates ?

(A) 11 (B) 10 (C) 9 (D) 8

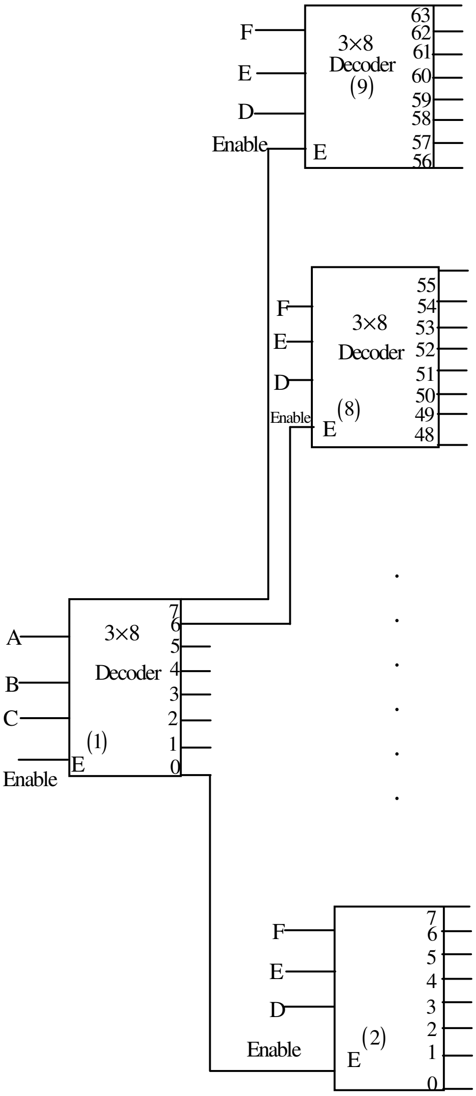
Key: (C)

Sol: 3 to 8 decoder $\rightarrow$ 6 to 64 decoder

$$\frac{64}{8} + \frac{8}{8}$$

$8 + 1 = 9$

(Or)



66. The minterm expansion of

$F(A,B,C)=AB+B\bar{C}+A\bar{C}$ is

(A) $m_2+m_4+m_6+m_1$

(B) $m_0+m_1+m_3+m_5$

(C) $m_7+m_6+m_2+m_4$

(D) $m_2+m_3+m_4+m_5$

Key: **(C)**

Sol: $F(A,B,C)=AB+B\bar{C}+A\bar{C}$

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

$=ABC+AB\bar{C}+AB\bar{C}+\bar{A}B\bar{C}+AB\bar{C}+A\bar{B}\bar{C}$

$=m_2+m_4+m_6+m_7$

67. The output of a NOR gate is

(A) high if all of its inputs are high

(B) low if all of its inputs are low

(C) high if all of its inputs are low

(D) high if only one of its inputs is low

Key: **(C)**

Sol: Truth Table of NOR-gate

A	B	Y (NOR – o/p)
0	0	1
0	1	0
1	0	0
1	1	0

68. If the input to a T flip-flop is a 100 MHz signal, the final output of three T flip-flops in a cascade is

(A) 1000 MHz (B) 520 MHz

(C) 333 MHz (D) 12.5 MHz

Key: **(D)**

Sol: $f_{\text{output (final)}}=\frac{f_i}{2^3}=\frac{100\text{MHz}}{8}=12.5\text{MHz}$

69. The addition of the two numbers $(1A8)_{16}+(67B)_{16}$ will be

(A) $(889)_{16}$ (B) $(832)_{16}$

(C) $(823)_{16}$ (D) $(723)_{16}$

Key: **(C)**

Sol:
1A 8 $\rightarrow (424)_{10}$
67 B $\rightarrow (1659)_{10}$

$(823)_{16} \Leftarrow (2086)_{10}$

70. If the operating frequency of an 8086 microprocessor is 10 MHz and, if, for the given instruction, the machine cycle consists of 4 T-states, what will be the time taken by the machine cycle to complete the execution of that same instruction when three wait states are inserted?

(A) $0.4\mu s$ (B) $0.7\mu s$
(C) $7\mu s$ (D) $70\mu s$

Key: (B)

Sol: $T = \frac{1}{f} = \frac{1}{10\times10^6} = 0.1\mu s$

Total number of states = 4T+3T=7T

$7\times0.1\mu s = 0.7\mu s$

71. The probability density function $F(x) = ae^{-b|x|}$, where x is a random variable whose allowable value range is from $x = -\infty$ to $x = +\infty$. The CDF for this function for $x \ge 0$ is

(A) $\frac{a}{b}e^{bx}$ (B) $\frac{a}{b}\left(2-e^{-bx}\right)$

(C) $-\frac{a}{b}e^{bx}$ (D) $-\frac{a}{b}\left(2+e^{-bx}\right)$

Key: (B)

Sol: The CDF is basically the integration of pdf.

$$F_X(x) = \int_{-\infty}^{x} f_x(\alpha)d\alpha$$

Since $x \ge 0$

$$F_X(x) = \int_{-\infty}^{0} ae^{b\alpha}d\alpha + \int_{0}^{x} ae^{-b\alpha}d\alpha$$

$$= \frac{a}{b}e^{b\alpha}\Big|_{-\infty}^{0} + \frac{a}{-b}e^{-b\alpha}\Big|_{0}^{x}$$

$$= \frac{a}{b} + \left[\frac{a}{-b}e^{-bx} + \frac{a}{b}\right]$$

$$= 2\frac{a}{b} - \frac{a}{b}e^{-bx} = \frac{a}{b}\left[2-e^{-bx}\right]$$

72. Consider the following statements regarding electrical properties of ceramic materials :

1. They are practically non conductors at lower temperatures.
2. Ordinary glass and silicates in molten state are dependable as electrical non-conductors.
3. They offer high resistance to current transmission and get heated soon when conducting electric current.

Which of the above statements are correct ?

(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (C)

73. If primary and secondary windings of core-type single-phase transformer are wound on non-magnetic core, then the

1. efficiency of the transformer will decrease
2. efficiency of the transformer will increase
3. transformer regulation will increase
4. transformer regulation will decrease

Which of the above possibilities are realized?

(A) 1 and 4 (B) 1 and 3
(C) 2 and 3 (D) 2 and 4

Key: (C)

Sol: As core get removed hence no core loss and power loss is reduced and efficiency increases and regulation also increases.

74. In the case of small BJT model with common emitter, the collector current i_c is 1.3 mA, when the collector-emitter voltage is v_{ce} of 2.6 V. The output conductance of the circuit is

(A) $2.0 m\Omega$ (B) $2.0 m℧$
(C) $0.5 m\Omega$ (D) $0.5 m℧$

Key: **(D)**

Sol: $g_{ce} = \frac{i_c}{v_{ce}} = \frac{1.3mA}{2.6} = \frac{1}{2} \times 10^{-3}$

$= 0.5m℧$

75. An FM broadcasting radio station transmits signals of frequency 100 MHz with a power of 10 kW. The bandwidth of the modulation signal is from 100 Hz to 1.5 kHz. If the maximum deviation set by the FCC, (δ), is 75 kHz, the range of the modulation index is

(A) 100 to 750 (B) 100 to 250

(C) 50 to 750 (D) 50 to 250

Key: **(C)**

Sol: Modulation index $P = \frac{\Delta f}{f_m}$

If $f_m = 100Hz, \beta = \frac{75 \times 10^3}{100} = 750$

If $f_m = 1.5\,kHz\ \beta = \frac{75 \times 10^3}{1.5 \times 10^3} = 50$

76. An amplitude-modulated amplifier has a radio frequency output of 60W at 100% modulation. The internal loss in the modulator is 6W. What is the unmodulated carrier power?

(A) 33W (B) 36W

(C) 40W (D) 44W

Key: **(D)**

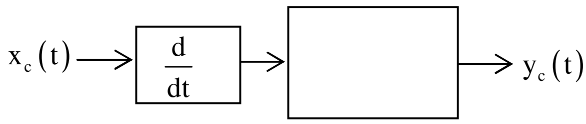
Sol: Power at the input of modulator $= 66W\,(60W + 6W\ loss)$

Total power

$P_T = P_C\left[1 + \frac{\mu^2}{2}\right] \Rightarrow 66 = P_C\left[1 + \frac{1}{2}\right]$

$\Rightarrow P_C = \frac{66 \times 2}{3} \Rightarrow P_C = 44\ watt$

77. The figure shows the block diagram of a frequency discriminator. What does the second block represent?



(A) Envelope detector

(B) Low-pass filter

(C) Ratio detector

(D) Band-reject filter

Key: **(A)**

Sol: Due to derivative operation, message signal information is available in the envelope.

Thus to extract message signal, envelop detector in needed.

78. A dominant pole is determined as

(A) the highest frequency pole among all poles

(B) the lowest frequency pole at least two octaves lower than other poles

(C) the lowest frequency pole among all poles

(D) the highest frequency pole at least two octaves higher than other poles

Key: **(B)**

79. If only one multiplexer and one inverter are allowed to be used to implement any Boolean function of n variables, what is the maximum size of the multiplexer needed?

(A) 2^{n-2} line to 1 line

(B) 2^{n-1} line to 1 line

(C) 2^{n+1} line to 1 line

(D) 2^{n+2} line to 1 line

Key: **(B)**

Sol: To implement a Boolean function of n variables, the maximum, size of the multiplexer needed is 2^{n-1} line to 1 line.

80. What is the minimum $\frac{E_b}{N_0}$ required to achieve a spectral efficiency of 6bps/Hz ?

(A) 5.2 (B) 5.3
(C) 10.5 (D) 15.8

Key: (C)

Sol: Channel capacity

$$C = B\log_2[1+SNR]$$

$$SNR = \frac{\text{signal power}}{\text{noise power}} = \frac{E_b.C}{N_o.B}$$

$$\Rightarrow \frac{C}{B} = \log_2\left[1+\frac{E_b}{N_o}.\frac{C}{B}\right]$$

$$\Rightarrow \frac{E_b}{N_o} = \frac{2^{C/B}-1}{C/B}$$

$$\text{Now } \frac{C}{B} = 5 \text{ bps/Hz} \Rightarrow \frac{E_b}{N_o} = \frac{2^6-1}{6} = 10.5$$

81. What is the required bandwidth of a PCM system for 256 quantization levels when 48 telephone channels, each band-limited to 4kHz, are to be time-division multiplexed by this PCM?

(A) 6.246 MHz (B) 3.464 MHz
(C) 3.072 MHz (D) 1.544 MHz

Key: (C)

Sol: Bandwidth required $= nf_s$

No. of bits, $n = \log_2 256 = 8$

$f_s \rightarrow$ sampling frequency

Since nothing in given on sampling frequency, we assume sampling frequency as $2f_m$.

$f_s = 8000$ samples/sec.

$\Rightarrow$ Total data rate $= 48\times8\times8000 = 3{,}072{,}000$ bits/sec

Then Bandwidth required = 3.072 MHz

82. The modulation scheme used in GSM is

(A) Frequency shift keying
(B) Phase shift keying
(C) Gaussian minimum shift keying
(D) Amplitude shift keying

Key: (C)

83. The basic motivation behind the development of digital modulation techniques is

(A) to develop a digital communication field
(B) to institute methods for translating digital message from baseband to passband
(C) to develop digitized versions of analog modulation schemes
(D) to improve upon pulse modulation scheme

Key: (B)

84. The received signal level for a particular digital system –151dBW and the effective noise temperature of the receiver system is 1500K. The value of $\frac{E_b}{N_0}$ required for a link transmitting 2400 bps is

(A) –12dB (B) –1.2dB
(C) +1.2 dB (D) +12 dB

Key: (D)

Sol: $\frac{E_b}{N_0} = -151\text{dBW} - 10\log 2400$

$-10\log 1500 + 228.6\text{dBW}$

$= 12\text{dBW}$

85. The largest error between reference input and output during the transient period is called

(A) Peak error
(B) transient overshoot
(C) peak overshoot
(D) transient deviation

Key: (C)

86. Consider the following statements regarding 'relative stability'.

1. in terms of gain margin only
2. in terms of phase margin and certain other parameters
3. in terms of gain margin, phase margin and location of poles in s-plane.
4. in relation to another identified system.

Which of the above statements are correct?

(A) 1 and 2 (B) 2 and 3

(C) 3 and 4 (D) 1 and 4

Key: **(C)**

87. Consider the following statements

For a type-1 and a unity feedback system, having unity gain in the forward path.

1. positional error constant K_p is equal to zero.
2. acceleration error constant K_a is equal to zero
3. steady state error e_{ss} per unit-step displacement input is equal to 1

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1 and 2 only

(C) 2 and 3 only (D) 1 and 3 only

Key: **(C)**

88. Consider a discrete memoryless source with source alphabet $S=\{s_0, s_1, s_2\}$ with probabilities

$$P(s_0)=\frac{1}{4}, P(s_1)=\frac{1}{4} \text{ and } P(s_2)=\frac{1}{2}$$

The entropy of the source is

(A) $\frac{1}{2}$ bit (B) $\frac{2}{3}$ bit

(C) $\frac{3}{2}$ bits (D) $\frac{1}{3}$ bit

Key: **(C)**

Sol: $H(s)=\frac{1}{4}\log_2 4+\frac{1}{4}\log_2 4+\frac{1}{2}\log_2 2$

$=\frac{3}{2}$ bits

89. For a lead compensator, whose transfer function is given by $K\frac{s+a}{a+b}; a,b \geq 0$

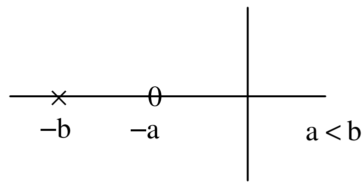
(A) $a < b$ (B) $a > b$

(C) $a \geq Kb$ (D) $a=0$

Key: **(A)**

Sol: For lead compensation

$$\text{Transfer function } = \frac{K(s+a)}{(s+b)}$$



90. A unity feedback system has open loop transfer function with two of its poles located at –0.1, 1; and two zeros located at –2 and –1 with a variable gain K. For what value(s) of K would the closed-loop system have one pole in the right half of s-plane?

(A) $K > 0.3$ (B) $K < 0.05$

(C) $0.05 < K < 0.3$ (D) $K > 0$

Key: **(C)**

Sol: $$G(s)H(s)=\frac{k(s+1)(s+2)}{(s+0.1)(s-1)}$$

$$(s+0.1)(s-1)+k(s^2+3s+2)=0$$

$$s^2(k+1)+s(3k-0.9)+(2k-0.1)=0$$

$$s^2+s\frac{(3k-0.9)}{(k+1)}+\frac{(2k-0.1)}{(k+1)}=0$$

$3k - 0.9 < 0$ $\quad 2k - 0.1 > 0$

$k < 0.3$ $\quad k > 0.05$

$\therefore 0.05 < k < 0.3$

91. Consider that in a system loop transfer function, addition of a pole result in the following

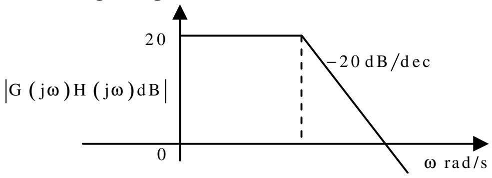
1. Roots locus gets pulled to the right hand side.
2. Steady-state error is increased.
3. Systems response gets slower.

Which of the above are correct?

(A) 1, 2 and 3 (B) 1 and 2 only
(C) 1 and 3 only (D) 2 and 3 only

Key: (C)

92. The magnitude plot for the open-loop transfer function of control system is shown in the figure given below.



Its open-loop transfer function, $G(s)H(s)$, is

(A) 10(s + 1) (B) $\frac{1}{s+1}$

(C) $\frac{10}{s+1}$ (D) 20(s + 1)

Key: (C)

Sol: $G(s)\ H(s) = \frac{k}{(s+1)}$

$20 = 20\log k \ ;k = 10$

$G(s)\ H(s) = \frac{10}{(s+1)}$

93. The open-loop transfer function of a unity feedback control system is

$$G(s)H(s) = \frac{10}{s(s+2)(s+K)}$$

Here K is a variable parameter. The system will be stable for all values of

(A) $K > -2$ (B) $K > 0$
(C) $K > 1$ (D) $K > 1.45$

Key: (D)

Sol: $G(s)\ H(s) = \frac{10}{s(s+2)(s+k)}$

C.E $\quad 1 + G(s)\ H(s) = 0$

$C.E \Rightarrow s^3 + s^2(k+2) + 2ks + 10 = 0$

Routh table

s^3	1	2k
s^2	k+2	10
s^1	$\frac{2k(k+2)-10}{k+2}$	
s^0	10	

$k > -2$

$2k^2 + 4k - 10 > 0$

$k > 1.45, -3.45$

$k > 1.45$

94. A control system has $G(s) = \frac{10}{s(s+5)}$ and H(s) =K. what is the value of K for which the steady-state error for unit step input is less than 5%?

(A) 0.913 (B) 0.927
(C) 0.953 (D) 1.050

Key: (D)

Sol: C.L.T.F. $\Rightarrow \frac{10}{s^2 + 5s + 10k}$

$$\frac{E(s)}{R(s)} = 1 - \frac{C(s)}{R(s)}$$

$$E(s) = R(s)\left(1 - \frac{C(s)}{R(s)}\right)$$

Apply final value theorem

$$E(s) = \frac{1}{s}\left(1 - \frac{10}{s^2 + 5s + 10k}\right)$$

$$E(s) = \lim_{s\to 0} s \times \frac{1}{s}\left(1 - \frac{10}{s^2 + 5s + 10k}\right)$$

$$E(s) = 1 - \frac{1}{k}$$

$e_{ss} < 5\%$ $\quad e_{ss} < 0.05$

$1 - \frac{1}{k} < 0.05$

$k < 1.05$

95. What is the time required to reach 2% of steady-state value, for the closed-loop transfer function

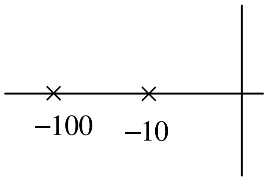
$\frac{2}{(s+10)(s+100)}$, when the input is u(t) ?

(A) 20 s (B) 2 s

(C) 0.2 s (D) 0.02s

Key: **(C)**

Sol: $\frac{C(s)}{R(s)} = \frac{2}{(s+10)(s+100)}$



$-100 \rightarrow$ insignificant pole

$-10 \rightarrow$ dominant pole

$z = 0.1\text{sec}$

$\pm 2\%$ error $t_s = 42 = 0.4$ sec

96. If the characteristics equation of a closed-loop system is $2s^2 + 6s + 6 = 0$, then the system is

(A) Over damped

(B) critically damped

(C) under damped

(D) undamped

Key: **(C)**

Sol: $2s^2 + 6s + 6 = 0$

$s^2 + 3s + 3 = 0$

$\omega_n = \sqrt{3}\text{rad / sec}$

$2\xi\omega_n = 3$

$\xi =< 1$ under damped system.

97. For derivative control action, the actuating signals consists of proportional error signal with addition of

(A) derivation of the error signals

(B) integral of the error signals

(C) steady-state error

(D) a constant which is a function of the system type

Key: **(A)**

Sol: Controller output $= k_p e(t) + \frac{d}{dt} e(t)$

Controller output is proportional error signal with addition of rate of change of the error signal.

98. Consider the following statements regarding a PID controller

1. The error is multiplied by a negative (for reverse action) proportional constant P, and added to the current output.
2. The error is integrated (averaged) over a period of time and then divided by a constant I, and added to the current control output.
3. The rate of change of the error is calculated with respect to time, multiplied by another constant D, and added to the output.

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1 and 3 only

(C) 1 and 2 only (D) 2 and 3 only

Key: **(A)**

99. A 32kB RAM is formed by 16 numbers of a particular type of SRAM IC. If each IC needs 14 address bits, what is the IC capacity?

(A) 32k bits (B) 16 k bits
(C) 8 k bits (D) 4k bits

Key: (B)

Sol: Total capacity
$=32kB=32k\times 8\text{ bits}=256\text{ kbits}$
Since 16 IC's are used, each IC provides 256 kbits/16=16kbits
Hence, capacity of each IC is 16 kbits.
Since, 14 bits address gives 16 kilo locations; each chip has 16 kilo locations. Hence, the IC organization is $16k\times 1$ i.e., capacity of each IC is 16 kbits.

100. A cache line has 128 bytes. The main memory has latency 64 ns and bandwidth 1GB/s. the time required to fetch the entire cache line is

(A) 32ns (B) 64ns
(C) 96ns (D) 192ns

Key: (D)

Sol: Given bandwidth = 14 bps
Latency = 64 ns
A cache lines has 128 bytes.
As per given bandwidth,
10^9 bytes $\Rightarrow 1\sec$

$$2^7\text{ Bytes}\Rightarrow 2^7\times\frac{1}{10^9}=2^7\text{ ns}$$

Latency is given 64 ns
Therefore total time required to place cache line is latency + data transfer time
$\Rightarrow 64\text{ ns}+128\text{ ns}=192\text{ ns}$

101. An asynchronous link between two computers uses the start-stop scheme with one start bit and one stop bit, and transmission rate of 48.8 kbits/s. what is the effective transmission rate as seen by the two computers ?

(A) 480 bytes/s (B) 488 bytes/s
(C) 4880 bytes/s (D) 4800 bytes/s

Key: (C)

Sol: A serial asynchronous link contains start and stop bits along with data bits of 8. So, as per question, one start bit is given and one stop bit is given. So

$\Rightarrow$

1 start bit	8 data bits	1 stop bit

$\therefore$ Total number of bits = 1 start bit + 1 stop bit + 8 data bits = 10 bits.
$\therefore$ Efficiency

$$(\eta)=\frac{\text{Number of data bit sent}}{\text{Total number of bits}}$$

$$=\frac{8}{10}=80\%(\text{or})0.8$$

Given Transmission rate (Bandwidth) = 48.8 kbits/sec
As we know that, effective transmission rate is also called as throughput.

$$\eta=\frac{T}{B}$$

Where T = Throughput, B = Bandwidth

$$\Rightarrow \text{Throughput}=\eta\times B=0.8\times 48.8\text{kbps}$$

$$=\frac{8}{10}\times 48.8\times 10^3\text{Bps}$$

$$=\frac{48.8\times 10}{10}\text{Bps}$$

$$\frac{488}{10}\times 100\text{ Bps}$$

$=4880$ bps $\Rightarrow$ Hence option (C) is correct.

102. The noise factor of an attenuator pas that has an insertion loss of 6dB is

(A) 0.25 (B) 0.5 (C) 2 (D) 4

Key: (D)

Sol: Noise factor $(F) = \dfrac{\left(S/N\right)_i}{\left(S/N\right)_o}$

103. A weighted complete graph with n vertices has weights $2|i-j|$ at edges (v_i, v_j). The weight of a minimum spanning tree is.

(A) $\frac{n^2}{2}$ (B) $\frac{n}{2}$

(C) 2n –2 (D) n –1

Key: **(C)**

Sol: $2+2+2+....+2(n-1 \text{ edges})$

$= 2(n-1)$

$= 2n-2$

104. Consider the following statements regarding the functions if an operating systems in a computer.

1. It controls hardware access
2. It manages files and folders.
3. It provides a user interface
4. It manages a user application.

Which of the above statements are correct?

(A) 1, 2 and 3only (B) 1,2 and 4 only

(C) 3 and 4 only (D) 1, 2, 3 and 4

Key: **(D)**

Sol: Statement 1 is "correct" because OS is a control program which manages computer hardware.

Statement 2 is "correct" because OS is also called as resource manager.

Statement 3 and 4 are "correct" because OS is an interface between user and hardware of the computer.

Hence, all the given 4 statements are "correct". So option D

105. Consider the following processes which arrived in the order P_1, P_2 and P_3

Process	Burst time
P_1	24 ms
P_2	3 ms
P_3	3 ms

What is the average waiting time by FCFS scheduling?

(A) 17 ms (B) 19ms

(C) 21 ms (D) 23 ms

Key: **(A)**

Sol: Given snapshot and FCFS scheduling is used.

PID	AT	BT (in ms)	C	TAT	WT
P_1	0	24	2	24	0
P_2	0	3	2	27	24
P_3	0	3	3	30	27

Gantt chart

P_1	P_2	P_3

0 24 27 30

Therefore average waiting time

$= \frac{0+24+27}{3} = \frac{51}{3} = 17 \text{ ms.}$

106. The cumulative distributions function of a random variable x is the probability that X takes the value

(A) less than or equal to x

(B) equal to x

(C) greater than x

(D) zero

Key: **(A)**

Sol: Probability, R.V and R.P

$F_X(x) = P\{X \le x\}$.

↑

CDF

107. A disk unit has 24 recording surface. It has a total of 14000 cylinders. There is an average of 400 sectors per track. Each sector contains 512 bytes of data. What is the data transfer rate at a rotational speed of 7200 r.p.m?

(A) 68.80×10^{6} bytes/s

(B) 24.58×10^{6} bytes/s

(C) 68.80×10^{3} bytes/s

(D) 24.58×10^{3} bytes/s

Key: **(B)**

Sol: Number of sectors / track = 400

As per question, 1 sector $\Rightarrow$ 512 bytes

So that, size of the track

$\Rightarrow$ 400 sectors $\Rightarrow 400\times512$ Bytes

Rotational speed = 7200 rpm

$\Rightarrow$ 60 sec $\rightarrow$ 7200 rotations

$$1 \text{ sec} \Rightarrow \frac{7200}{60} = 120 \text{ rotations}$$

$$\Rightarrow 1 \text{ rotation} \Rightarrow \frac{1}{120}\text{sec} \Rightarrow 400\times512 \text{ bytes}$$

$$\Rightarrow 1 \text{ sec} = 120\times400\times512 \text{ bytes}$$

$$= 24.58\times10^{6} \text{ bytes / sec}$$

108. In the demand paging memory, a page table is held in registers. If it takes 1000ms to service a page fault and if the memory access times is 10ms, what is the effective access time for a page fault rate of 0.01 ?

(A) 19.9 ms (B) 10.9 ms

(C) 9.99 ms (D) 0.99 ms

Key: **(A)**

Sol: In demand paging,

$$EAT = P*S + (1-P)*m$$

Where

P = Page fault rate

S = Page fault service time

M = Memory access time

As per question,

S = 1000 ms

M = 10 ms

P = 0.01

Therefore Effective Access Time (EAT)

$$= (0.01)(1000) + (1-0.01)(10)$$

$$= 10 + 9.9 = 19.9 \text{ ms}$$

Hence option A.

109. Consider the following statements regarding database normal forms

1. Any relation with two attributes is BCNF
2. Lossless, dependency - preserving decomposition into BCNF is always possible.
3. Lossless, dependency - preserving decomposition into 3NF is always possible.
4. BCNF is stricter than 3NF.

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1, 3 and 4

(C) 1, 2 and 4 (D) 2, 3 and 4

Key: **(B)**

Sol: **1.** Every relation with two attributes will be in BCNF. Because, if the relation has two attributes the possible F_D sets are as follows.

I. R AB

{ $A \rightarrow B$ }

BCNF

II. R AB

{ $B \rightarrow A$ }

BCNF

III. R AB

{
A → B
B → A
}

IV. R AB

{
}

BCNF

2&3. Lossless and dependency preserving decomposition into 3 NF is always possible but lossless and dependency preserving BCNF may not be always possible [lossless decomposition into BCNF is always possible but dependency preserving BCNF may not always be possible].

4. BCNF is stricter than 3 NF because a table is in BCNF if LHS of every F_D is super key. If this condition is satisfied there will not be any partial and transitive dependency $\Rightarrow$ table will be in 3 NF for sure. But if a table is in 3 NF it will not be knowing partial and transitive dependencies but LHS of every F_D need not be super key $\Rightarrow$ table need not be in BCNF.

110. Consider the following schedules for transactions T_1, T_2 and T_3

T_1	T_2	T_3
Read (X)		
	Read (Y)	
		Read (Y)
	Write (Y)	
Write (X)		
		Write (X)
	Read (X)	
	Write (X)	

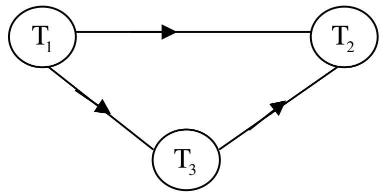
The correct schedule of serialization will be

(A) $T_1 \to T_2 \to T_3$ (B) $T_2 \to T_3 \to T_1$

(C) $T_3 \to T_1 \to T_2$ (D) $T_1 \to T_3 \to T_2$

Key: (D)

Sol:



$\Rightarrow T_1 \to T_3 \to T_2$

111. A receiver tunes signals from 550 kHz to 1600kHz with an IF of 455 kHz. The frequency tuning range ratio for the oscillator section of the receiver is nearly

(A) 2.90 (B) 2.05

(C) 1.65 (D) 1.30

Key: (B)

Sol: Frequency tuning range ratio

$$= \frac{1600+455}{550+455} = \frac{2055}{1005} = 2.047 \approx 2.05$$

112. In a basic transmission line the voltage at the receiving end without load is 660V; and it is 420V with full load. What is the percentage of voltage regulation?

(A) 77% (B) 67%

(C) 57% (D) 47%

Key: (C)

Sol: $$\text{Voltage regulation} = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100$$

$$= \frac{660-420}{420} \times 100 = 57\%$$

113. A quarter - wave transformer of characteristics impedance 60Ω has been used to match a transmission line of 72Ω. What is the characteristic impedance of the transformer, when the load of 72Ω is replaces by 98Ω ?

(A) 98Ω (B) 80Ω

(C) 70Ω (D) 60Ω

Key: (C)

Sol: $Z_{in} = \frac{Z_0}{Z_L} = \frac{60^2}{72} = 50\Omega$

$Z_0 = \sqrt{50\times 98}$

$= 70\Omega$

114. Consider the following statements

Stokes' theorem is valid irrespective of

1. Shape of closed curve C
2. type of vector A
3. type of coordinate system
4. whether the surface is closed or open.

Which of the above statements are correct?

(A) 1, 2 and 4 (B) 1, 3 and 4

(C) 2, 3 and 4 (D) 1, 2 and 3

Key: (D)

Sol: Strokes theorem : $\int_C \bar{F}.d\bar{\ell} = \iint_S \bar{\nabla}\times\bar{F}.\bar{ds}$

open Surface

115. A plane y = 2 carries an infinite sheet of charge $4nC/m^2$. If the medium is free space, what is the force on point charge of 5 mC located at the origin?

(A) $0.54\pi\bar{a}_y N$ (B) $0.18\pi\bar{a}_y N$

(C) $-0.36\pi\bar{a}_y N$ (D) $-0.18\pi\bar{a}_y N$

Key: (C)

Sol: Electric field due to infinite sheet of charge is

$E = \frac{\rho_s}{2\epsilon}\hat{a}_N$

$= \frac{4\times 10^{-9}}{2\times 8.854\times 10^{-12}}(-\hat{a}_y)$

Force on charge is

$F = qE = 5\times 10^{-3}$

$\times\frac{4\times 10^{-9}}{2\times 8.854\times 10^{-12}}(-\hat{a}_y)$

$= \frac{20}{2\times 8.854} = -1.13\hat{a}_y$

$= -0.36\pi\hat{a}_y$

116. A random process X(t) is called 'white noise' if the power spectral density is equal to

(A) $\frac{\pi}{8}$ (B) $\frac{\pi}{2}$

(C) $\frac{3\pi}{4}$ (D) π

Key: (*)

Sol: Incorrect options

117. What us the reflection coefficient for the line $Z_o = 300\angle 0°$ and $Z_L = 150\angle 0°\Omega$?

(A) 0.5 (B) 0.333

(C) –0.333 (D) –0.5

Key: (C)

Sol: $\Gamma_L = \frac{150\angle 0^o - 300\angle 0^o}{1500\angle 0^o + 300\angle 0^o}$

$= \frac{-150}{450} = -\frac{1}{3}$

3

$= -0.333$

118. An electromagnetic wave is transmitted into a conducting medium of conductivity σ. The depth of penetration is

(A) directly proportional to frequency

(B) directly proportional to square root of frequency

(C) inversely proportional to frequency

(D) inversely proportional to square root of frequency

Key: **(D)**

Sol: skin depth $\delta = \sqrt{\dfrac{2}{\omega\mu\sigma}}$; $\delta \, \alpha \dfrac{1}{\sqrt{f}}$

119. Which of the following are the properties of TEM mode in a lossless medium?

1. Its cut-off frequency is zero.

2. Its transmission line is a hallow waveguide.

3. Its wave impedance is the impedance in a bounded dielectric

4. Its phase velocity is the velocity of light in an unbounded dielectric.

Select the correct answer using the code given below.

(A) 1, 2 and 3 (B) 1, 3 and 4

(C) 1, 2 and 4 (D) 2, 3 and 4

Key: **(C)**

Sol: $\eta_{TEM} = \eta_0 = 120\pi\Omega$

Statements given are are the properties of TEM wave.

120. Consider the following statements

Plane wave propagation through a circular waveguide result in

1. TE modes

2. TM modes

Which of the above statements is/are correct?

(A) 1 only (B) 2 only

(C) Either 1 or 2 (D) Both 1 and 2

Key: **(D)**

121. In VLSI n- MOS process, the thinox mask

(A) patterns the ion implantation within the thinox region

(B) deposits polysilicon all over the thikox region

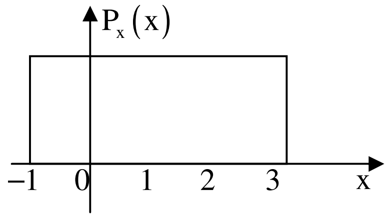
(C) patterns thickox regions to expose silicon where source, drain or gate areas are required

(D) grows thickox over thinox regions in gate areas

Key: **(A)**

Sol: Property of end fire array.

122. For a random variable x having the PDF shown in the figure given below.



The mean and the variance are respectively

(A) 0.5 and 0.66 (B) 2.0 and 1.33

(C) 1.0 and 0.66 (D) 1.0 and 1.33

Key: **(D)**

Sol: Probability, R.V and R.P

$$\text{mean} = \frac{a+b}{2} = \frac{-1+3}{2} = 1$$

$$\text{variance} = \frac{(b-a)^2}{12} = \frac{(3-(-1))^2}{12}$$

$$= \frac{16}{12} = 4/3 = 1.33$$

123. Consider the statements with respect to bilinear transformation method of digital design

1. It preserves the number of poles and there by the order of the filter.

2. It maintains the phase response of analog filter

3. The impulse response of the analog filter is not preserved.

Which of the above statements are correct?

(A) 1, 2 and 3 (B) 1 and 2 only

(C) 1 and 3 only (D) 2 and 3 only

Key: **(C)**

Sol: Bilinear transform does not maintain the phase characteristics of the Analog Filter & there is no way to correct the phase response to match.

124. Consider the following statements
The 8259A programmable interrupt controller can
1. manage eight interrupts
2. vector an interrupt request anywhere in the memory map.
3. have 8-bit and 16-bit interval between interrupt vector locations
4. be initialized with operational command words.
Which of the above statements are correct?
(A) 1, 2 and 3 only (B) 1, 2 and 4 only
(C) 3 and 4 only (D) 1, 2, 3 and 4

Key: **(B)**

125. What are the conditions which are necessary for using a parallel port?
1. Initializing by placing appropriate bits at the control register.
2. Calling on interrupt whenever a status flag sets at the status register.
3. Interrupting servicing (device driver) programming
Select the correct answer using the code given below.
(A) 1, 2 only (B) 1 and 3 only
(C) 1, 2 and 3 (D) 2 and 3 only

Key: **(B)**

126. Consider a point-to-point communication network represented by a graph. In terms of graph parameters, the maximum delay (quality of service) experienced by a packet employing Bellman-Ford routing algorithm is/are
1. diameter of the graph
2. Shortest path on the graph
3. sum of all edges weights in the graph
Select the correct answer using the code given below.
(A) 1 only (B) 2 only
(C) 3 only (D) 1, 2 and 3

Key: **(B)**

Sol: Basically, Routing Algorithms are used to find the shortest path between any 2 nodes. As per question, it is given Bellman-Ford routing algorithm (Distance vector routing algorithm) is used to find shortest path on the graph. Hence, option (B) is correct.

127. Lets RSA prime number be p = 3 and q = 11. If the corresponding public key e = 3, what is the private key?
(A) 4 (B) 5 (C) 6 (D) 7

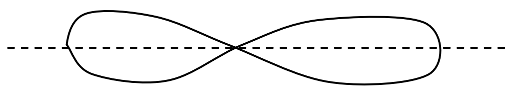
Key: **(D)**

Sol: Given: $p = 3 \quad q = 11 \quad e = 3 \quad d = ?$
As per RSA algorithm,
Step 1: Chosen $p = 3$ and $q = 11$
Step 2: Compute $n = p \times q = 3 \times 11 = 33$
Step 3: Compute
$$\phi(n) = (p-1)(q-1) = (2)(10) = 20$$
Step 4: Given e = 3, so compute a value for d such that
$\Rightarrow d\ .e.\ \text{mod}\ \phi(n) = 1$
$\Rightarrow d\ .3\ \text{mod}\ 20 = 1$
$\Rightarrow d = 7$

128. The maximum radiation for an endfire array occurs at
(A) $\phi_0 = 0$ (B) $\phi_0 = \frac{\pi}{2}$
(C) $\phi_0 = -\frac{\pi}{2}$ (D) $\phi_0 = \frac{3\pi}{2}$

Key: **(A)**

Sol: The radiation pattern of end fire array



The minimum radiation occur at $\phi_o = 0^o$

129. Consider the following statements regarding TCP:

1. It enables two hosts to establish connections and exchange streams of data.
2. It guarantees delivery of data in the same order in which they are sent
3. TCP segmentation offload is used to reduce the CPU overhead of TCP/IP on fast networks

Which of the above statements are correct?

(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

Sol: Statement 1 is "correct" because TCP is a connection oriented protocol.
Statement 2 is "correct" because TCP provides reliable delivery
Statement 3 is "correct" because TCP segment offload (TSO) breaks down large groups of data sent over a network into smaller segments that pass through all the network elements between the source and destination. This type of off load relies on the NIC to segment the data and then add the TCP, IP and DLL protocol headers to each segment. TSO is also called as LSO "large segment offload".

130. The transmission path loss for a geostationary satellite signal for uplink frequency of 6GHz is

(A) 60dB (B) 92 dB
(C) 184 dB (D) 200dB

Key: (D)

Sol: Path Loss

$= 34.52 + 20\text{lag}\, f_{MHz} + 20\text{lag}\ d_{km}$

$f_{MHz} = 6000MHz$

$d_{km} = 36,000Km$

$\Rightarrow$ Path Loss

$= 34.52 + 20\text{lag}_{10} 6000 + 20\log 36,000$

$= 34.52 + 75.56 + 91.126$

$= 200dB$

131. Consider the following statements

If the maximum range of radar has to be doubled

1. The peak transmitted power may be increased 16 folds
2. the antenna diameter may be doubled
3. the sensitivity of receiver may be doubled
4. the transmitted pulse width may be doubled

Which of the above statements are correct?

(A) 1and 2 (B) 2 and3
(C) 3 and 4 (D) 1 and 4

Key: (A)

Sol: Radar Range equation

$$R = \sqrt[4]{\frac{P_t G^2 \lambda^2 \sigma}{(4\pi)^3 P_{min}}}$$

For R to be doubled

P_t need to be 16 times

G need to be 4 times

$\Rightarrow$ Area need to be inverse 4 times diameter to be doubled.

132. What is the maximum signal propagation time for a geosynchronous satellite transmission system?

(A) 140ms (B) 220ms
(C) 280ms (D) 560 ms

Key: (C)

Sol: A geostationary satellite is visible from a little less than 1/3rd of earth's surface & if you are located at the edge of this Area the satellite appears to be just above the horizon. The distance to satellite is greater & for earth stations at the extreme edge of the coverage Area, the distance to satellite is approx is 41756 km. If you were to communicate with another similarly located site, the total distance is nearly 84000 km, so the end to end delay is 280 msec.

133. The field strength at the receiving antenna location at a distance of 28 km from a half-wave dipole transmitter radiating 0.1kW is

(A) 1.5 mV/m (B) 2.5 mV/m
(C) 3.5 mV/m (D) 4.5m V/m

Key: (B)

Sol: $P_{avg} = G_d \dfrac{P_{rad}}{4\pi r^2}$

$G_d = 1.5$ for half wave dipole. $P_{avg} = \dfrac{|E_s|^2}{2\eta}$

$$\frac{|E_s|^2}{2\times120\pi} = 1.5\frac{0.1\times10^3}{4\pi\left(28\times10^3\right)^2}$$

$$|E_s| = 2.39\times10^{-3}\,\text{V/m.}$$

134. Consider the following loop

```
    MOV  CX, 8000h
L1:      DEC  CX
         JNZ  L1
```

The processor is running at 14.7456/3 MHz and DEC CX requires 2 clock cycles and JNZ requires 16 clock cycles. The total time taken is nearly

(A) 0.01s (B) 0.12s (C) 3.66s (D) 4.19s

Key: (B)

Sol: Total time taken

$$= \frac{3}{14.7456}\times10^{-6}\times18\times8\times16^3$$

$$= 0.12\,\text{sec}$$

135. A microwave communication link employs two antennas for transmission and reception elevated at 200m and 80m, respectively. Considering obliqueness of the earth, the maximum possible link distance is

(A) 46 km (B) 64 km
(C) 96 km (D) 102 km

Key: (C)

Sol: $d \simeq 4.12\left(\sqrt{h_t} + \sqrt{h_r}\right)$

$$= 4.12\left(\sqrt{200} + \sqrt{80}\right)$$

$$= 4.12(14.14 + 9) \simeq 96\text{km}$$

136. Consider a packet switched network based on a virtual circuit mode of switching. The delay jitter for the packets of a session from the source node to the destination node is/are

1. always zero
2. non-zero
3. for some networks, zero

Select the correct answer using the code given below.

(A) 1 only (B) 2 only
(C) 3 only (D) 2 and 3

Key: (A)

Sol: In a packet switched network based on a virtual circuit mode of switching the delay jitter for the packets of a session from source to destination node is always zero because a packet can be forwarded before the next packet arrives.

137. Molybdenum has Body-Centered cubic (BCC) structure with an atomic radius of 1.36 Å. Then the lattice parameter for BCC molybdenum is

(A) 2.77 Å (B) 3.14 Å

(C) 5.12 $\overset{o}{A}$ (D) 6.28 $\overset{o}{A}$

Key: **(B)**

Sol: $a = \frac{4R}{\sqrt{3}}$

$= \frac{4\times1.36}{\sqrt{3}} = 3.14A^0$

Directions:

Each of the next thirteen (13) items consists of two statements, one labeled as 'statement (I)' and the other as 'statement (II)'. Examine these two statements carefully and select the answer to these items using the code given below.

Codes:

(A) Both statement (I) and statement (II) are individually true and statement (II) is the correct explanation of statement (I)

(B) Both statement (I) and statement (II) are individually true but statement (II) is not the correct explanations of statements (I)

(C) Statement (I) is true but statement (II) is false

(D) Statement (I) is false but statement (II) is true

138. Statement (I): The coupling between two magnetically coupled coils is said to be ideal if the coefficient of coupling is unity.

Statement (II): Lower the self-inductance of a coil, more will be the e.m.f induced

Key: **(C)**

Sol: Statement – I is true.

Statement – II: - We have, $V = L.\frac{di}{dt}$

Where, L is self – inductance of a coil and V is induced EMF (or) voltage.

As induced EMF and self – inductance are directly proportional to each other. Hence statement – II is wrong.

139. Statement (I): The direction of dynamically induced e.m.f in a conductor is determined by Fleming's left-hand rule.

Statement (II): The mutual inductance between two magnetically isolated coils is zero.

Key: **(B)**

Sol: Both statements are true but statement II is not reason for statement I

140. Statement (I): Photodiodes are not used in relay circuits

Statement (II): The current needed to activate photodiodes is very low even at high light intensities.

Key: **(D)**

Sol: Photo diodes are commonly used in relay circuits which we called photo relay circuits.

141. Statement (I): An autotransformer is economical in using copper in its manufacture.

Statement (II): The section of the winding common to both primary and secondary circuits carries only the different of primary and secondary currents.

Key: **(B)**

142. Statement (I): FIR filters are always stable.

Statement (II):IIR filters require less memory and are less complex.

Key: **(B)**

Sol: For a finite input, the output is also always finite in FIR filters. Thus the system is stable. For an FIR filter, H(z) contains only zeros thus they need more memory. While the

H(z) of IIR filters contain both zeros and poles and it requires less memory.

143. Statement (I): Nuclear power plants are suitable only for base load operation

Statement (II): Nuclear power reactor cannot response to load fluctuation efficiently

Key: (A)

144. Statement (I): Solar insolation is a measure of solar irradiance over a specified period of time

Statement (II): Solar insolation data are commonly used for isolated PV system design.

Key: (B)

145. Statement (I): The smallest change of input detectable at the output is called the resolution of a transducer.

Statement (II): A high resolution means high accuracy.

Key: (B)

146. Statement (I): Constant M and N circles as also Nichols charts are graphical techniques to assess closed-loop performance in the frequency domain.

Statement (II): While constant M and N circles use Nyquist polar plots data Nichols chart uses Bode plots data.

Key: (B)

147. Statement (I): PID controller is an essential part of any control loop in process industry.

Statement (II): PID control system performs better than most predictive control methods in the context of measured disturbances.

Key: (A)

148. Statement (I): Large RAM with MOS circuit technology is used for the main memory in a computer system.

Statement (II): An important application of ROM is to store system programs, library subroutines, etc.

Key: (B)

149. Statement (I): Elements with non-minimum phase transfer functions introduce large phase lags with increasing frequency resulting in complex compensation problems

Statement (II): Transportation lag commonly encountered in process control systems is a non-minimum phase element.

Key: (B)

150. Statement (I): Speech enhancement techniques are used to make a processed speed signal sound superior to the unprocessed one.

Statement (II):A 'Perfect signal' is required as reference for speech enhancement.

Key: (C)

Sol: Speech Enhancement is done Based on requirement not tuned on perfect signal (which is not available).