SOLUTIONS

S1. Ans. (b)
Sol. We know that Characteristics Impedance is = and it is independent of length of line.

S2. Ans.(b)
Sol. Given:
- = 100
- = 25

We know that Characteristics Impedance is
=

Now, =
So, = 50 ohm

S3. Ans.(d)
Sol. Using formula
μ =
Putting values

= 400 KΩ

S4. Ans.(b)
Sol. A slip test is conducted on synchronous generator to determine Direct and quadrature axis reactance.
From slip test:

S5. Ans.(a)
Sol. In higher voltage, beyond 33KV, it becomes uneconomical to use pin insulator because size, weight of the insulator become more. Handling and replacing bigger size single unit insulator are quite difficult task. For overcoming these difficulties, **suspension insulator** is used for HV application.

S6. Ans.(a)
Sol. 3-phase synchronous machine rotor construction:
• **Salient pole rotor:** larger diameter, shorter axial length
• **Cylindrical pole rotor:** smaller diameter, larger axial length

S7. Ans.(b)
Sol. Open-loop gain (A) of system = 100
β =?
For oscillator Aβ = 1
100 × β = 1
β =
= 0.01

S8. Ans.(d)
Sol. H×S is constant.

S9. Ans.(d)
Sol.

Final value theorem

S10. Ans.(c)
Sol. A transistor can amplify a signal only when it is operated in active region.
Active region is also called a linear region. A transistor operates in active region when emitter base junction is forward biased and collector base junction is reverse biased.

S11. Ans.(c)
Sol. **SC test of transformer:** short circuit test gives the copper losses; these losses are taken into consideration by series parameters of the equivalent circuit. While, Open circuit test gives us iron losses; which are shown by parallel components of equivalent circuit.
Power factor
And
So, during SC test of transformer, both power factor and magnitude of current is inversely proportional to frequency(f).
Therefore, as frequency of a transformer decreases then both power factor and current increases and vice-versa.

S12. Ans.(d)
Sol. Common collector (CC) also known as emitter follower circuit.

parameters	CB	CE	**CC**
Input impedance	Low	Low	**High**
Output impedance	Very high	High	**Low**
Phase inversion	No	Yes	**No**
Voltage gain	High	High	**<1**
Current gain	<1	High	**High**

S13. Ans.(a)
Sol. $A = V_1/V_2$ and $D = I_1/I_2$. They are ratios of voltages and currents respectively.
The **ABCD parameters of transmission line** can be tabulated as: -

Parameter	Specification	Unit
$A = V_S / V_R$	Voltage ratio	Unit less

$B = V_S / I_R$	Short circuit resistance	Ω
$C = I_S / V_R$	Open circuit conductance	mho
$D = I_S / I_R$	Current ratio	Unit less

S14. Ans.(b)
Sol. A two-port network is said to be symmetrical if the ports of the two-port network can be interchanged without changing the port voltages and currents. This will hold good, if $Z_{11} = Z_{22}$.

S15. Ans.(b)
Sol. A two-port network is said to be symmetrical if the ports of the two-port network can be interchanged without changing the port voltages and currents. This will hold good, if A = D.
For Z-parameter, $Z_{11} = Z_{22}$ (condition of symmetry).

S16. Ans.(c)
Sol. Regenerative switching circuits such as **Astable Multivibrators** are the most commonly used type of relaxation oscillator because not only are they simple, reliable and ease of construction they also **produce a constant square wave output waveform**.
An astable multivibrator is one which does not have any stable state. It has two quasi-stable output states which keep toggling at regular intervals. The output waveform is thus a square wave and this circuit is also called a square wave generator or a free running oscillator.

S17. Ans.(a)
Sol. An astable multivibrator is a square wave generator. Charging and discharging times of the capacitor are equal and thus the output waveform has a duty cycle of 50%.
Astable multivibrators generally have an even 50% duty cycle, i.e. 50% of the cycle time the output is "HIGH" and the remaining 50% of the cycle time the output is "OFF".

S18. Ans.(d)
Sol. Here

$$SWR = \frac{1 + |\rho_v|}{1 - |\rho_v|} = \frac{1.2}{0.8} = 1.5.$$

S19. Ans.(b)
Sol. Multivibrators have two different electrical states, an output "HIGH" state and an output "LOW" state giving them either a stable or quasi-stable state depending upon the type of multivibrator.
Monostable Multivibrators have only **ONE** stable state (hence their name: "Mono"), and produce a single output pulse when it is triggered externally. A monostable multivibrator, also called a one shot, **is** a sequential logic electronic circuit that

generates an output pulse. When triggered, a pulse of pre-defined duration **is** produced. The circuit then returns to its stable state and produces no more output until triggered again.

S20. Ans.(d)
Sol. The purpose of guard ring in transmission lines is to:

- Reduce the earth capacitance of the lowest unit
- Equal voltage distribution across each disc

S21. Ans.(a)
Sol.

- The Y bus matrix is used for the load flow studies.
- Z bus algorithm or matrix is used for the fault analysis.

S22. Ans.(b)
Sol.

- The Y bus matrix is used for the load flow studies.
- Z bus algorithm or matrix is used for the fault analysis.

S23. Ans.(b)
Sol. **Load bus:**
Known quantities - P and Q
Unknown quantities - V and δ
Generator bus:
Known quantities - P and V
Unknown quantities - Q and δ
Slack or reference bus:
Known quantities - V and δ
Unknown quantities - P and Q

S24. Ans.(a)
Sol. **Load bus:**
Known quantities - P and Q
Unknown quantities - V and δ
Generator bus:
Known quantities - P and V
Unknown quantities - Q and δ
Slack or reference bus:
Known quantities - V and δ
Unknown quantities - P and Q

S25. Ans.(c)
Sol.

S26. Ans.(b)

Sol. Inductance of a line.
$L = 2\times10^{-7}$ ln
and. GMR Radius of the conductor
If radius increases then GMR will increase and inductance will decrease.

S27. Ans.(b)
Sol. Surge impedance loading: MW
i.e.,
Where;

- **SIL is independent of length of line.**
- SIL can be increased by increasing voltage level and vice-versa.

S28. Ans.(a)
Sol. An overhead transmission line is provided with earth wire for protection against voltage surge due to direct lightning stroke.

S29. Ans.(b)
Sol. A lightning arrester:

- Provides low impedance path for surge current
- Is connected in parallel with the equipment under protection.

S30. Ans.(d)
Sol. Zener diode is used as a Shunt voltage regulator for regulating voltage across small loads. The breakdown voltage of Zener diodes will be constant for a wide range of current. Zener diode is connected parallel to the load to make it reverse bias and once the Zener diode exceeds knee voltage, the voltage across the load will become constant.

S31. Ans.(b)
Sol. For ramp input type-2 system,

S32. Ans.(a)
Sol. Modulation index
m =
=

S33. Ans.(c)
Sol. The term artificial aging in instrument is associated with permanent magnet.
Over a long period of time, permanent magnets are gradually demagnetized by the impact of heat fluctuation. The degree of deterioration depends on the type and material of magnet and the magnetic characteristics.

S34. Ans.(d)
Sol. The Schering bridge use for measuring the low permeability of the dielectric material.
NOTE:

The Schering bridge use for measuring the capacitance of the capacitor, dissipation factor, properties of an insulator, capacitor bushing, insulating oil and other insulating materials. It is one of the most commonly used AC bridge.

S35. Ans.(b)
Sol. Commercially, **stepper motors are used in** floppy disk drives, flatbed scanners, **computer printers,** plotters, slot machines, image scanners, compact disc drives, intelligent lighting, camera lenses, CNC machines, and 3D printers.

S36. Ans.(c)
Sol. Zener diode shows regulator action in reverse biased condition only.

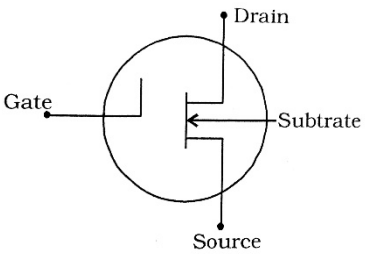
S37. Ans.(a)
Sol. For half wave rectifier:
And

S38. Ans.(c)
Sol. A Thermistor or Thermal resistor is defined as a type of resistor whose electrical resistance varies with changes in temperature.
There are two types of thermistors:

- Negative Temperature Coefficient (NTC)
- Positive Temperature Coefficient (PTC).

S39. Ans.(a)
Sol.

S40. Ans.(d)
Sol. Schematic symbol of n-channel MOSFET:



S41. Ans.(a)
Sol. Advantages of FET: -

- high input impedance
- low output impedance
- low noise level
- excellent buffer amplifier

S42. Ans.(a)

Sol. Drain to source current is

-

Transconductance is

-
- =

S43. Ans. (a)

Sol. Form factor is

- F

S44. Ans.(b)

Sol. Given:

- Voltage range or Dynamic Range = 8 V

The maximum Quantization error is

Q_e = = where n is no. of bit

Now, Q_e =

Q_e =

Q_e = 0.5

S45. Ans. (a)

Sol. Basically two types of networks exist:

- Active network – a network that has own source of energy,
- Passive network –a network does not have any source of energy of its own.

S46. Ans.(a)

Sol. The effect in which the voltage at the receiving end of the transmission line is more than the sending voltage is known as the Ferranti effect. Such type of effect mainly occurs because of light load or open circuit at the receiving end.

S47. Ans.(d)

Sol. Leading kVAR supplied = P (tan 1 – tan 2)

S48. Ans.(d)

Sol. FET is a positive resistance characteristic i.e. The current flow does not drop with increase in voltage or vice versa.

S49. Ans.(c)

Sol.

Drain current

= 32 × 0.1914
= 6.125 mA

S50. Ans.(d)
Sol. In the state of saturation a MOSFET acts as a closed switch. According the saturation mode MOSFET–

and
If slowly increase the gate voltage starting from '0' the MOSFET remains off.

S51. Ans.(b)
Sol.

S52. Ans.(c)
Sol.

and slip is equal to .

S53. Ans.(b)
Sol. Modulation index

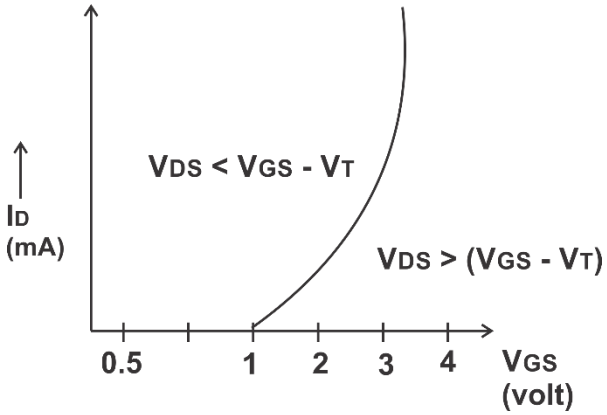
S54. Ans.(b)
Sol. Efficiency
For maximum efficiency,

S55. Ans.(c)
Sol. According to **Carson's rule**, BW
Where;

S56. Ans.(a)
Sol. According to Carson's rule, BW

S57. Ans.(a)
Sol. The minimum anode current required to turn off the SCR is the latching current. The value of the latching current is 2 A.

S58. Ans.(c)
Sol.



Enhancement type MOSFET operates in the saturation region when and drain voltage does not fall below the gate voltage by more than .
i.e.,

S59. Ans.(d)
Sol. Properties of FET: -
(i) Unipolar device
(ii) Voltage controlled
(iii) current flow due to only majority charge carries
(iv) Zero offset voltage, so better than chopper.

S60. Ans.(d)
Sol. A universal gate is a logic gate which can implement any Boolean function without the need to use any other type of logic gate. The NOR gate and NAND gate are universal gates.

S61. Ans.(b)
Sol. for unity feedback control system,
If CLTF
Then, OLTF .
So, for given control system, OLTF .

S62. Ans.(d)
Sol. Closed loop transfer function =

$$\frac{G(s)}{1+G(s)H(s)} = \frac{(s+4)}{(s^2+7s+13)}$$

Given system is a unity feedback control system, Open loop transfer function

$$G(s) = \frac{(s+4)}{s^2+7s+13-(s+4)}$$

$$G(s) = \frac{(s+4)}{(s^2+6s+9)}$$

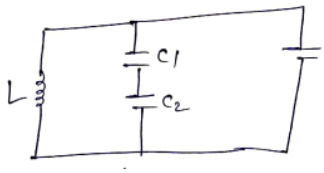
For DC gain AC terms should be zero, i.e., s = 0 Therefore, open loop DC gain G(s) = 4/9.

S63. Ans.(a)
Sol. Compensators in control system are used to improve the performance specifications, i.e., transient and steady state characteristics.

- **Lead Compensator:** It is used for improving the transient state or speed response of the system.
- **Lag Compensator:** It is used for improving steady state response characteristics of the system, i.e., elimination of steady state error between output and input.
- **Lag-Lead or Lead-Lag Compensator:** It improves both transient and steady state response characteristics. It exhibits both lead and lag characteristics in its frequency response.

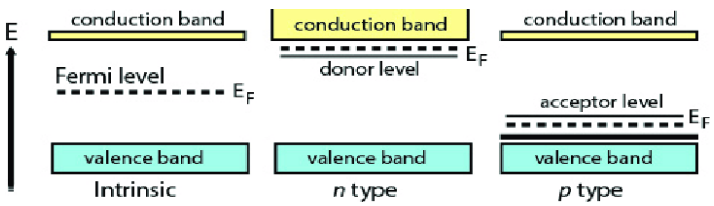
S64. Ans.(b)
Sol. Transfer function = L (impulse response)
The transfer function in terms of Laplace transform of impulse response is known as weighting function.
$L(e^{-t}) = 1/(s+1)$

S65. Ans.(b)
Sol. Colpitts's oscillator works in Class-C mode.
Colpitts's oscillators—



Where

S66. Ans.(a)
Sol. Fermi energy level () for P- type extrinsic semiconductors lie close to valence band and for N-type, it is close to conduction band.



S67. Ans.(c)
Sol. B = Curl(A).
I.e., = ×

S68. Ans.(c)
Sol. Given:

- Ratio of charges stored by two metallic spheres raised to the same potential is = 6

Charged stored on a metallic sphere is Q = CV
Capacitance of metallic sphere is C = 4πR
Surface area of metallic sphere is S = 4π
Now,

=

6 =

= 6

again, = = 6^2 = 36

S69. Ans.(b)
Sol. FM: Audio signal
AM: VIDEO signals

S70. Ans.(a)
Sol. FM: Audio signal
AM: VIDEO signals

S71. Ans.(a)
Sol. m=
=
= =0.5

S72. Ans.(c)
Sol. =
For, m=0
=
For m=1
=

S73. Ans.(c)
Sol.
According to question, voltage is reduced by 20%, i.e.,

So, is reduced by 36 %.

S74. Ans.(d)
Sol. Resolution

S75. Ans.(c)
Sol. steady state error is reduced by Lag compensator.

S76. Ans.(b)
Sol. memory size=16K=16×1024 bytes=
So, the number of address lines required to address a memory size of 16K is **14.**

S77. Ans.(b)
Sol. The non-uniform distribution of electric current over the surface or skin of the conductor carrying a.c is called the skin effect. In other words, the concentration of charge is more near the surface as compared to the core of the conductor.

Factors affecting skin effect

1. **Frequency** – Skin effect increases with the increase in frequency.
2. **Diameter** – It increases with the increase in diameter of the conductor.
3. **The shape of the conductor** – Skin effect is more in the solid conductor and less in the stranded conductor because the surface area of the solid conductor is more.
4. **Type of material** – Skin effect increase with the increase in the permeability of the material (Permeability is the ability of material to support the formation of the magnetic field).

S78. Ans.(c)
Sol. Properties of an ideal OP-AMP:

- Infinite Input Resistance
- Zero Output Impedance
- Infinite Open-loop Gain
- Infinite Common-mode Rejection Ratio
- Infinite Bandwidth

S79. Ans.(d)
Sol. A transformer is defined as a passive electrical device that transfers electrical energy from one circuit to another through the process of electromagnetic induction. It is most commonly used to increase ('step up') or decrease ('step down') voltage levels between circuits. As the transformer is a Static device or both windings are at standstill, Frequency does not change in Transformer.

S80. Ans.(b)
Sol.
As series reactance unchanged,

S81. Ans.(a)
Sol. **TRAP:**

- Non-maskable
- highest priority
- hardware interrupt

S82. Ans.(c)
Sol. Address Latch Enable (ALE) is used to select either address or data bus –

- If ALE = 1, Address bus line is selected
- otherwise for ALE = 0, Data bus line is selected.

Multiplexing and Demultiplexing of data bus line takes place.

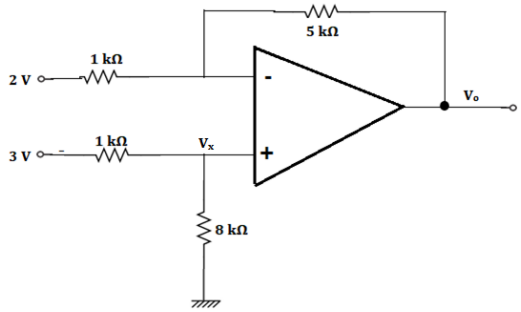
S83. Ans.(b)
Sol. Here .
According to sampling theorem, to avoid aliasing
2×100=200 Hz. (minimum)

S84. Ans.(a)
Sol. The cause of radio interference in communication lines is electromagnetic induction.
Radio interference in UHV AC substations mainly comes from corona on such equipment as busbars, fittings, and insulators. When the electric field strength on the surface busbar, fitting, and insulator and other energized conductors in the switchyard exceed the critical value, resulting in ionization of surrounding air followed by corona discharge, radio interference is stimulated.

S85. Ans.(a)
Sol.
OR GATE output=(A+B)
1ST AND output=(A+B) C
2ND AND output=[(A+B) C] D
3RD AND output=

S86. Ans.(b)
Sol. Given:

- Op-amp is ideal.
- feedback resistor () = 5 kΩ
- = 1 kΩ
- Inverting terminal voltage () = 2 V
- non-Inverting terminal voltage () = 3 V



As input voltage is applied to both the inverting and non-inverting terminal, so the output voltage will be due to both.
We will calculate using voltage divider rule,
= × = × 3
= V
Now, = × + (1 +) ×

$= \times 2 + (1 +) \times$

$= -10 + 6 \times$

$= -10 + 16$

So, $= 6$ V

S87. Ans.(b)

Sol. In Ideal operational amplifier, Input resistance is infinite and output resistance is zero. So, it matches the characteristic of Voltage Controlled Voltage Source. Hence, an ideal Op-Amp is an ideal Voltage Controlled Voltage Source.

S88. Ans.(a)

Sol. By considering $\omega = 0$ and $\omega = \infty$, we can check the type of filter.

At $\omega = 0$, All capacitor behaves as open circuit so output voltage is equal to input voltage.

$= 1$

At $\omega = \infty$, All capacitor behaves as short circuit so input voltage at non-inverting terminal becomes zero.

$= 0$

This is similar to the Low Pass Filter characteristics. So, the above figure behaves as a Low Pass Filter.

S89. Ans.(c)

Sol.

S90. Ans.(a)

Sol. SCR remains ON even when gate current or trigger pulse is removed. It can be turned OFF by reversing the polarity of anode and cathode voltage.

S91. Ans.(d)

Sol.

- The value of di/dt can be maintained below the acceptance limit by using a small inductor in series with anode circuit. It is called di/dt inductor.
- A snubber circuit is used in parallel with the device to prevent the false turn ON of SCR by large dv/dt.
- t is limited by using fuse.
- Junction temperature is controlled by the use of heat sink.

S92. Ans.(c)
Sol. In the forward blocking region of SCR the anode terminal is made positive with respect to cathode while the gate terminal kept open. In this state, junctions and are forward biased and the junction is reverse biased. In this mode, voltage applied across the SCR is less than the break over voltage hence offering a very high resistance to the current flow. It acts as an Open switch or in the OFF state.

S93. Ans.(a)
Sol.

- TRIAC is used in High Voltage DC System.
- IGBT are used in motor control circuits to control its speed, position or electromagnetic torque by controlling the supplied voltage.
- SCR is use in medium to high-voltage AC power control applications, such as lamp dimming, regulators.
- UJT has negative resistance region so it is used in Pulse Generation.

S94. Ans.(b)
Sol. If there is higher rate of increase in applied voltage then the SCR is not damaged permanently. SCR is triggered ON due to large applied voltage so it is not damaged.

S95. Ans.(a)
Sol. Electrostatics instruments are suitable for only voltage (AC or DC) measurement but not for measuring current, power energy etc.

S96. Ans.(d)
Sol. Time constant =

S97. Ans.(c)
Sol. For DC series motor, Torque.

S98. Ans.(d)
Sol. Eddy current loss
And we know,

- If , then eddy current loss
- If is not constant, then eddy current loss

S99. Ans.(c)
Sol.

S100. Ans.(a)
Sol. In Induction motor stator magnetic field rotates at the speed of synchronous speed. The stator is made up of Silicon steel and remains at rest. The relative speed is

.