

EE-Objective-Paper-I (Set-A)

1. The electric field lines and equipotential lines
 (A) are parallel to each other
 (B) are one and the same
 (C) cut each other orthogonally
 (D) can be inclined to each other at any angle

Key: (C)

Exp: Electric field lines and equipotential lines are always orthogonal to each other.

2. According to Gauss's Law, the surface integral of the normal component of electric flux density D over a closed surface containing charge Q is

(A) $\frac{Q}{\epsilon_0}$ (B) $\epsilon_0 Q$ (C) Q (D) $\frac{Q^2}{\epsilon_0}$

Key: (C)

Exp: From Gauss's law

$$\oint_S \mathbf{D} \cdot d\mathbf{S} = Q_{enc}$$

3. Consider the following statements:

A current I flows through a circular coil of one turn of radius R in the counter-clockwise direction.

1. The magnetic field at the centre is inversely proportional to R .
2. The magnetic moment of the coil is directly proportional to R^2 .
3. The magnetic field at its centre is directly proportional to R^2 .

Which of the above statements is/are correct?

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

Key: (A)

Exp: $H = \frac{I}{2\pi R}$, $H \propto \frac{1}{R}$

Magnetic moment (m) is given as

$$m = I\pi R^2 a_n$$

$$m \propto R^2$$

4. The depth of penetration of wave in a lossy dielectric medium increases with
 (A) Increasing wavelength
 (B) Increasing conductivity

- (C) Decreasing wavelength
- (D) Increasing permittivity

Key: (A)

$$\text{Exp: } \alpha = \frac{1}{\delta} = \sqrt{\frac{\omega\mu\sigma}{2}}$$

$$\delta = \frac{1}{\sqrt{\pi f \mu \sigma}}$$

$$\delta \propto \frac{1}{\sqrt{f}} \propto \sqrt{\lambda}$$

So, δ – increases with increase in wave length (λ).

5. Consider the following statements associated with the basic electrostatic properties of ideal conductors:

1. The resultant field inside is zero.
2. The net charge density in the interior is zero.
3. Any net charges reside on the surface.
4. The surface is always equipotential.
5. The field just outside is zero.

Which of the above statements are correct?

- (A) 1, 2, 3 and 4
- (B) 3, 4 and 5 only
- (C) 1, 2 and 3 only
- (D) 2 and 3 only

Key: (A)

- Exp:
1. The electric and magnetic field inside conductor is zero.
 2. The net charge density inside the conductor is zero.
 3. The complete charge resides on the surface at the conductor only.
 4. The conductor is an equipotential surface.

6. In practice, Earth is chosen as a place of zero electric potential because it

- (A) is non-conducting
- (B) is easily available reference
- (C) keeps losing and gaining electric charge every day
- (D) has almost constant potential

Key: (D)

7. The capacitance of a concentric spherical capacitor of shell radii x and y ($x > y$) is

- (A) $\frac{1}{4\pi\epsilon_0} \ln \frac{x}{y}$
- (B) $\frac{4\pi\epsilon_0 xy}{x - y}$
- (C) $4\pi\epsilon_0 \ln \frac{y}{x}$
- (D) $\frac{1}{4\pi\epsilon_0} \left[\frac{1}{y} - \frac{1}{x} \right]$

Key: (B)

Exp: Capacitance of spherical Capacitor $C = \frac{4\pi\epsilon}{\frac{1}{x} - \frac{1}{y}} = \frac{4\pi\epsilon xy}{x - y}$

8. The frequency of the power wave associated with an electromagnetic wave having an E field as $E = e^{\frac{-z}{\delta}} \cos\left(\omega t - \frac{z}{\delta}\right)$, is given by

- (A) $\frac{\omega}{8\pi}$ (B) $\frac{\omega}{4\pi}$ (C) $\frac{\omega}{2\pi}$ (D) $\frac{\omega}{\pi}$

Key: (C)

Exp: Given, $E = e^{\frac{-z}{\delta}} \cos\left(\omega t - \frac{z}{\delta}\right)$

$$\omega = 2\pi f$$

$$f = \frac{\omega}{2\pi}$$

9. When the wave travels in a conducting medium, the rate of attenuation is decided by

- (A) Attenuation constant
(B) Phase constant
(C) Both attenuation constant and phase constant
(D) Neither attenuation constant nor phase constant

Key: (A)

Exp: The attenuation of the wave is decided by the attenuation constant only.

10. Uniform plane wave is

- (A) Longitudinal in nature
(B) Transverse in nature
(C) Neither longitudinal nor transverse in nature
(D) x-directed

Key: (B)

Exp: Uniform plane wave is transverse in nature.

11. The impedance Z offered by transmission line for a travelling wave which damps out the low frequency oscillation rapidly is also called

- (A) Surge impedance
(B) Natural impedance
(C) Both surge and natural impedances

(D) Neither surge nor natural impedance

Key: (A)

12. In a coaxial transmission line, the useful power flows through

- (A) the interface of the two conductors
- (B) both inner and outer conductors
- (C) inner conductor
- (D) outer conductor

Key: (A)

13. For a line to have a purely resistive characteristic impedance

- (A) $\frac{C}{G} = \frac{R}{L}$
- (B) $\omega L = \frac{1}{\omega C}$
- (C) $R = G$
- (D) $GL = RC$

where R and G are resistance and conductance per unit length respectively and L and C are inductance and capacitance per unit length respectively.

Key: (D)

Exp: $Z_o = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$

$$= \sqrt{\frac{L \left(\frac{R}{L} + j\omega \right)}{C \left(\frac{G}{C} + j\omega \right)}}$$

Let $\frac{R}{L} = \frac{G}{C}$

$$Z_o = \sqrt{\frac{L}{C}}$$

So, of Z_o to be real,

$$\frac{R}{L} = \frac{G}{C}$$

$$\boxed{RC = GL}$$

14. A semiconductor device made out of a material having very high temperature coefficient of resistance is

- (A) Transistor
- (B) Varistor
- (C) Thyristor
- (D) Thermistor

Key: (D)

15. The electrical conductivity of a semiconductor increases with increase in temperature because
- (A) the carrier concentration increases
 - (B) the mobility of carrier increases
 - (C) both carrier concentration and mobility increase
 - (D) the band gap decreases

Key: (A)

Exp: Temperature Dependence-Semiconductors

$$\sigma = ne^2T/m^*$$

In Semiconductors

1. The carrier concentration increases as temperature goes up, due to excitations across the band gap, E_g . n is proportional to $\exp\{-E_g/2kT\}$.
2. T is inversely proportional to temperature the exponential dependence dominates; therefore, a plot of $\ln \sigma$ vs $1/T$ is essentially linear.
3. Conductivity increases as temperature increases.

16. Which of the following are associated with soft superconductors?

1. Silsbee's rule
2. Meissner effect
3. Faraday rotaton
4. Curie-Weiss law

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

Key: (C)

17. In a two-channel oscilloscope operating in x-y mode, two in-phase 50 Hz sinusoidal waveforms of equal amplitude are fed to the two channels. What will be the resultant pattern on the screen?

- (A) An ellipse
- (B) A parabola
- (C) Straight line inclined at 45° with respect to x-axis
- (D) A circle

Key: (C)

18. Materials, whose resistivity at very low temperature plunges from a finite value to zero and remains there upon further cooling, are known as

- (A) Ferromagnetic materials
- (B) High-energy hard magnetic materials
- (C) Superconductors

(D) Ferrimagnetic materials

Key: (C)

Exp: Superconductivity is a phenomenon of exactly zero electrical resistance and expulsion of magnetic fields occurring in certain materials when cooled below a characteristic critical temperature.

19. In a superconductors , if the temperature is decreased below its critical temperature, the value of critical magnetic field will value of critical magnetic field will

(A) Increase

(B) Decrease

(C) Not change

(D) Increase or decrease depending on the superconductor material

Key: (A)

20. The imaginary part of dielectric constant determines

(A) Component of current which is in phase with the applied field

(B) Component of energy absorbed per m³

(C) Amount of applied field

(D) Component of voltage which is in phase with the applied field

Key: (B)

Exp: 1. It has real part (ϵ_r') that determines the charge storage ability and
2. An imaginary part (ϵ_r'') that determines the energy losses in material as a result of polarization mechanism.

Imaginary part determines energy power dissipation per unit volume as heat from an AC signal by $E^2 \omega \epsilon_0 \epsilon_r''$. ($\epsilon_r = \epsilon / \epsilon_0$)

21. Curie law of paramagnetism (with χ =susceptibility, B=flux density and C=a constant) is

(A) $\chi = CT$

(B) $\chi = \frac{CB}{T}$

(C) $\chi = \frac{CT^2}{2B}$

(D) $\chi = \frac{C}{T}$

Key: (D)

Exp: Low levels of magnetization, the magnetization of paramagnets follows what is known as Curie's law, at least approximately. This law indicates that the susceptibility χ of paramagnetic material is inversely proportional to their temperature, i.e. that materials become more magnetic at lower temperatures.

The mathematical expression is: $M = \chi H = \frac{C}{T} H$

$$\therefore \chi = \frac{C}{T}$$

22. If the magnetic susceptibility of a specimen is small and positive, the specimen is
- (A) Diamagnetic (B) Paramagnetic
(C) Ferromagnetic (D) Non-magnetic

Key: (B)

Exp: Paramagnetic specimen have a relative magnetic permeability greater than or equal to 1 (i.e., a positive magnetic susceptibility) and hence they are attracted to magnetic fields.

23. Manganese ferrite is a 1:1 mixture of
- (A) Manganese nitride and iron oxide
(B) Manganese oxide and iron oxide
(C) Manganese nitride and iron sulphide
(D) Manganese oxide and iron sulphide

Key: (B)

24. When a ferromagnetic substance is magnetized, small changes in dimensions occur. Such a phenomenon is known as

- (A) Magnetic hysteresis (B) Magnetic expansion
(C) Magnetostriction (D) Magneto-calorisation

Key: (C)

Exp: Magnetostriction is a property of ferromagnetic materials that causes them to change their shape or dimensions during the process of magnetization.

25. In ferromagnetic, anti-ferromagnetic and ferromagnetic materials, the atomic thermal motions counteract the coupling forces between the adjacent atomic dipole moments, thereby causing
- (A) Some dipole misalignment regardless of whether an external field is present
(B) Increase in dipole alignment regardless of whether an external field is present
(C) No effect on dipole alignment
(D) Atoms tend to de-randomize the direction of moments

Key: (A)

Exp: For ferromagnetic materials, the saturation magnetization decreases with increasing temperature because the atomic thermal vibrational motions counteract the coupling forces between the adjacent atomic dipole moments, causing some magnetic dipole misalignment.

26. The Hall Effect voltage in intrinsic silicon
- (A) is positive
(B) is zero
(C) is negative

(D) changes its sign based on application of magnetic field

Key: (C)

27. Most outstanding property of indium antimonide is

- (A) A very wide range gap
- (B) High resistivity at room temperature
- (C) High carrier mobility
- (D) Very low conductivity at room temperature

Key: (C)

Exp: Indium antimonide (InSb) is a narrow band gap semiconductor material with the zinc blende crystal structure. Its band gap is 0.17eV at 300 K and 0.23 eV at 80 K. The undoped semiconductor possesses the largest ambient temperature electron mobility ($7.8 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$).

28. Which of the following semiconducting compounds is used in photoconductive devices?

- (A) Caesium antimonide
- (B) Barium oxide
- (C) Lead sulphide
- (D) Zinc oxide

Key: (C)

Exp: 1. Most commercially available photoconductive cells are manufactured from cadmium sulfide (CdS)
2. Other materials that are less commonly used in photoconductive cells include lead sulfide (PbS), lead selenide (PbSe), and lead telluride (PbTe), although they react to infrared light, not the visible spectrum

29. A magnetic ring has a mean circumference of 20 cm and a cross-section of 20 cm^2 and has 800 numbers of turns of wire. When the exciting current is 5A, the flux is 2 mWb. The relative permeability of iron is nearly

- (A) 3.98
- (B) 398
- (C) 0.398
- (D) 39.8

Key: (D)

Exp: We know that $H = \frac{NI}{l}$

$$\phi = BA, \quad B = \mu_0 \mu_r H$$

$$\mu_r = ?$$

where $l = \text{circumference} = 20 \text{ cm} = 0.2 \text{ m}$

$$\text{So, } H = \frac{800 \times 5}{0.2} = 20000 \text{ A/m}$$

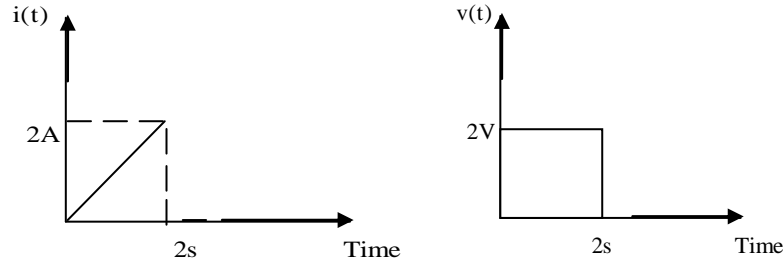
$$B = \frac{\phi}{A} = \frac{2 \times 10^{-3}}{20 \times 10^{-4}} = 1 \text{ Wb/m}^2$$

So,

$$\mu_r = \frac{B}{\mu_0 H} = \frac{1}{4\pi \times 10^{-7} \times 20,000}$$

$$\mu_r = 39.8$$

30. The voltage and current waveforms for an element are shown in the figures:



The circuit element and its value are

(A) Capacitor and 2F

(B) Inductor and 1H

(C) Inductor and 2H

(D) Resistor and 1Ω

Key: (C)

Exp: $i(t) = \frac{2}{2}t; \quad 0 \leq t < 2$

$i(t) = t; \quad 0 \leq t < 2$

$v_L(t) = L \frac{di(t)}{dt}$

$2 = (L)1$

$L = 2H$

31. For a series R-C circuit, the power factor corresponding to maximum power is

(A) 0.5 lag

(B) 0.5 lead

(C) 0.707 lag

(D) 0.707 lead

Key: (D)

Exp: For Maximum Power

$R_L = X_c$

So, $p.f = \cos \phi = \frac{R_L}{|Z|}$

$= \frac{R_L}{\sqrt{R_L^2 + R_L^2}} = 0.707$

Since circuit is capacitive p.f will be leading in nature.

32. The power consumed by a coil is 300 W when connected to a 30V dc source and 108 W when connected to a 30 V ac source. The reactance of the coil is
 (A) 3 Ω (B) 4 Ω (C) 5 Ω (D) 6.67 Ω

Key: (B)

33. A conductor of diameter d, length l consumes a power of W when a current I flows through it. What will be the power consumed if d is doubled, l is halved and current is tripled?
 (A) 18 W (B) 36 W (C) 48W (D) 72W

Key: $\frac{9}{8}W$ (Not matching with given options)

Exp: $P = I^2 \times R$

$$W = I^2 \times \frac{\rho l}{\pi d^2} \times 4$$

Now length is halved and 'd' is doubled and current is 'tripled'

$$W_1 = (3I)^2 \times \frac{\rho l \times 4}{2 \times \pi (2d)^2}$$

$$W_1 = \frac{9I^2 \times \rho l \times 4}{2 \times \pi \times 4d^2}$$

$$W_1 = \left(\frac{9}{8}\right) \frac{I^2 \times \rho l \times 4}{\pi d^2} = \left(\frac{9}{8}\right) W$$

34. When a source is delivering maximum power to a load, the efficiency of the circuit is always
 (A) 50% (B) 75%
 (C) 100% (D) Depends on the circuit parameters

Key: (A)

35. Consider the following statements:

Any element connected in

1. Series with an ideal current source is redundant.
2. Parallel with an ideal current source is redundant.
3. Series with an ideal voltage source is redundant.
4. Parallel with an ideal voltage source is redundant.

Which of the above statements is/are correct?

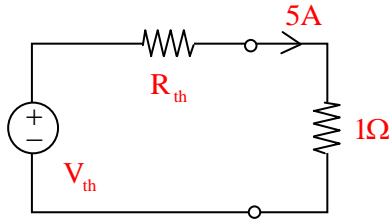
- (A) 1 only (B) 2 and 3 (C) 2 only (D) 1 and 4

Key: (D)

36. A battery charger can drive a current of 5A into a 1Ω resistance connected at its output terminals. If it is able to charge an ideal 2 V battery at 7A rate, then Thevenin's equivalent will be
- (A) 7.5 in series with 0.5Ω
(B) 12.5 V in series with 1.5 Ω
(C) 7.5 V in parallel with 0.5 Ω
(D) 12.5 V in parallel with 1.5 Ω

Key: (B)

Exp:

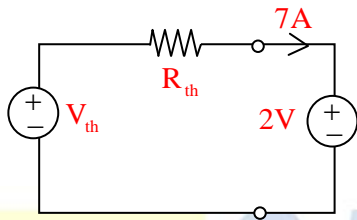


$$-V_{th} + 5R_{th} + 5 = 0 \quad \dots (1)$$

$$-V_{th} + 7R_{th} + 2 = 0 \quad \dots (2)$$

Solving (1) and (2)

$$V_{th} = 12.5V \text{ and } R_{th} = 1.5\Omega$$



37. The output power of a filter is 100 mW, when the signal frequency is 5 kHz, When the frequency is increased to 25 kHz, the output power falls to 50 mW. What is the dB change in power?
- (A) -3dB
(B) -5dB
(C) -7dB
(D) -2dB

Key: (A)

Exp: $P_o = 100mW, f_1 = 5 \text{ kHz}$

$P_o = 50 \text{ mW}, f_2 = 25 \text{ kHz}$

$$\text{dB change in power} = 10 \log \left(\frac{50 \text{ mW}}{100 \text{ mW}} \right) = 10 \log 0.5 = -3\text{dB}$$

38. The principle of operation used in capacitive transducers to measure level of liquid is change of
- (A) Area of plates
(B) Dielectric strength
(C) Distance between plates
(D) Shape of plates

Key: (B)

Exp: Capacitive level transducer is an example of indirect measurement of level

The technique is frequently referred as RF as radio frequency signals applied to the capacitance circuit. The sensors can be designed to sense material with dielectric constants as low as 1.1 (coke and fly ash) and as high as 88 (water) or more

39. In any network the current will be seen to be consisting of a forced current and natural current. A forced current is
- (A) A steady-state current with external source but a natural current is a transient current in a closed circuit with no external source.
 - (B) A transient current with external source but a natural current is a steady-state current in a closed circuit with no external source.
 - (C) A steady-state current in a closed circuit without external source, while a natural current is a transient current with an external source.
 - (D) A transient current in a closed circuit without external source, while a natural current is a steady-state current with an external source.

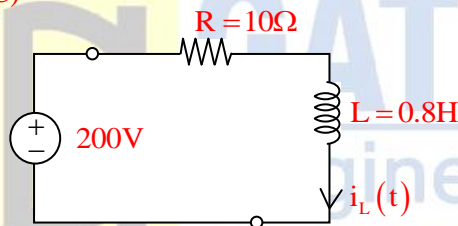
Key: (A)

Exp: A forced current is a steady-state current that gives zero state response.
A natural current is a transient current which gives zero input response.

40. A coil of resistance 10Ω and inductance 0.8 H is connected to a 200 V dc supply. The initial rate of change current is
- (A) 16 A/s
 - (B) 160 A/s
 - (C) 250 A/s
 - (D) 4000 A/s

Key: (C)

Exp:



$$i_L(t) = i_L(\infty) - (i_L(\infty) - i_L(0))e^{-tR/L}$$

$$\text{Here } i_L(\infty) = \frac{200}{10} = 20$$

$$i_L(0) = 0$$

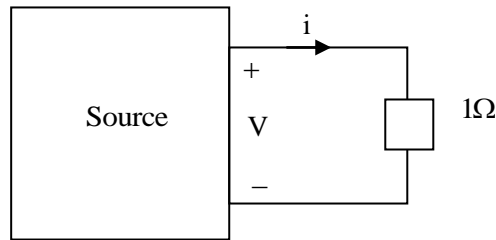
$$i_L(t) = 20 - 20e^{-\frac{t \times 10}{0.8}}$$

$$\text{At } t = 0, \frac{di_L}{dt} = 250\text{ A/sec}$$

41. There are no transient in pure resistance circuit because they
- (A) Offer high resistance
 - (B) Obey Ohm's law
 - (C) Have no stored energy
 - (D) Are linear circuits

Key: (C)

42. As shown in the figure, 1Ω resistance is connected across a source that has a load line $v+i=100$. The current through the resistance is



- (A) 25 A (B) 50 A (C) 100 A (D) 200 A

Key: (B)

Exp: $i = \frac{V}{1\Omega}$

$$i = \frac{(100-i)}{1\Omega}$$

$$2i = 100$$

$$i = 50A$$

43. The initial and final values of $f(t) = 15 - 10t - 10e^{-20t}$ are respectively
 (A) 5 and ∞ (B) 5 and $-\infty$ (C) 15 and ∞ (D) 15 and 10

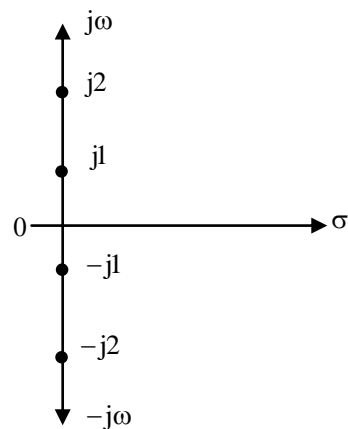
Key: (B)

Exp: Given $f(t) = 15 - 10t - 10e^{-20t}$

Initial value, at $t = 0$; $f(0) = 15 - 0 - 10(1) = 5$

Final value, at $t = \infty$; $f(\infty) = 15 - \infty = -\infty$

44. The pole-zero pattern of a certain filter is shown in figure. The filter must be



- (A) Low-pass type (B) High-pass type
 (C) Band-pass type (D) All-pass type

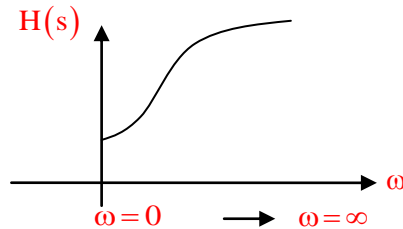
Key: (B)

Exp: According to given pole-zero pattern,

$$\text{Transfer function, } H(s) = (s^2+1)(s^2+4)$$

$$\text{At } s = 0 ; H(0) = 4$$

$$\text{At } s = \infty ; H(\infty) = \infty$$



∴ It attenuates low frequencies. Hence it acts as high pass filter.

45. A single-phase ac voltage source has 200 V rms and a system connected consumes an active power of 300 W. What is the reactive power consumed by the system if 2.5 A rms current is drawn?

(A) 100 VAR

(B) 200 VAR

(C) 300 VAR

(D) 400 VAR

Key: (D)

Exp: $V = 200V$

$$P_{\text{active}} = 300W$$

$$P_{\text{Reac}} = ?$$

$$I = 2.5A$$

$$P_{\text{active}} = VI \cos \theta$$

$$\cos \theta = \frac{300}{200 \times 2.5} = 0.6$$

$$P_{\text{Reac}} = VI \sin \theta$$

$$= 200 \times 2.5 \times \sqrt{1 - (0.6)^2}$$

$$P_{\text{Reac}} = 400 \text{ VAR}$$

46. The transfer function of a low-pass RC network is

(A) $RCs(1 + RCs)$

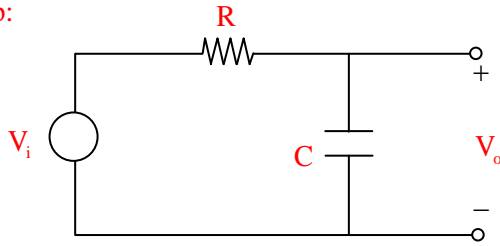
(B) $\frac{1}{(1 + RCs)}$

(C) $\frac{RC}{(1 + RCs)}$

(D) $\frac{s}{(1 + RCs)}$

Key: (B)

Exp:



$$V_o(s) = \frac{V_i(s) \frac{1}{Cs}}{R + \frac{1}{Cs}}$$

$$\frac{V_o(s)}{V_i(s)} = \left(\frac{1}{1 + RCs} \right)$$

47. An RLC resonant circuit has a resonance frequency of 1.5 MHz and bandwidth of 10 kHz. If $C = 150 \text{ pF}$, then effective resistance of the circuit will be

- (A) 29.5Ω (B) 14.75Ω (C) 9.5Ω (D) 4.7Ω

Key: (D)

Exp: $f_o = 1.5 \text{ MHz}$, $BW = 10 \text{ kHz}$, $C = 150 \text{ pF}$

$$\theta = \frac{f_o}{BW} = 150$$

$$f_o = \frac{1}{2\pi\sqrt{LC}}$$

$$\sqrt{LC} = \frac{1}{2\pi f_o} \Rightarrow L = \frac{1}{(4\pi^2 f_o^2 \times C)}$$

$$L = \frac{1}{4\pi^2 \times (1.5)^2 \times 10^{12} \times 150 \times 10^{-12}} = 7.505 \times 10^{-5}$$

$$\theta = \frac{\omega_o L}{R}$$

$$R = \frac{2\pi f_o L}{\theta} = \frac{2\pi \times 1.5 \times 10^6 \times 7.505 \times 10^{-5}}{150} = 4.7 \Omega$$

48. Consider the following two types of non-identical sources:

1. Voltage sources $e_1(t)$ and $e_2(t)$
2. Current sources $i_1(t)$ and $i_2(t)$

Regarding the mode of their connection in a circuit,

- (A) 1 cannot be connected in parallel, and 2 cannot be connected in series.
 (B) 1 cannot be connected in series, and 2 cannot be connected in parallel.
 (C) Both 1 and 2 cannot be connected in series.

(D) Both 1 and 2 cannot be connected in parallel

Key: (A)

Exp: Non identical voltage sources in Parallel disobey KVL.

Non identical current sources in series disobey KCL.

49. In a series resonant circuit, maximum voltage across L occurs at

- (A) Resonant frequency (B) Slightly below resonant frequency
(C) Slightly above resonant frequency (D) At a frequency where I is maximum

Key: (C)

50. Two wattmeters are used to measure the power in a 3-phase balanced system. What is the power factor of the load when one wattmeter reads twice the other?

- (A) 0 (B) 0.5 (C) 0.866 (D) 1

Key: (C)

Exp: In two-wattmeter method, when power factor is 0.866 (or) phase angle is 30° , one watt meter reads twice the other.

51. In a balanced 3-phase 200 V circuit, the line current is 115.5 A. When the power is measured by two wattmeter method, one of the wattmeter reads 20 kW and the other one reads zero. What is the power factor of the load?

- (A) 0.5 (B) 0.6 (C) 0.7 (D) 0.8

Key: (A)

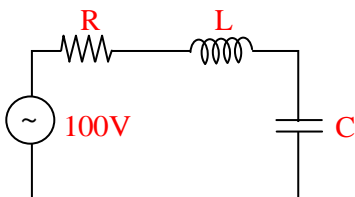
Exp: When one of the wattmeter reads zero, in two-watt meter method, the p.f is 0.5.

52. A coil having an inductance of 0.5 H and a resistance of 60Ω is connected in series with a capacitance of $10 \mu\text{F}$. The coil is connected to 100 V ac supply. What is the source frequency and current flowing in the circuit under resonance condition?

- (A) 7.121 Hz and 16.7 A
(B) 7.121 Hz and 1.67 A
(C) 71.21 Hz and 1.67 A
(D) 71.21 Hz and 1.67 A

Key: (D)

Exp:



$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$= \frac{1}{2\pi\sqrt{0.5 \times 10\mu}}$$

$$f_r = 71.21 \text{ Hz}$$

$$I = \frac{V}{R}$$

$$I = \frac{100}{60}$$

$$I = 1.67 \text{ A}$$

53. Three equal impedances are first connected in delta across a 3-phase balanced supply. If the same impedances are connected in star across the same supply then,
- (A) Phase current will be one-third
 - (B) Line current will be one-third
 - (C) Power consumed will be one-third
 - (D) Phase current will remain the same

Key: (C)

54. A Hurwitz polynomial $D(s)$ must satisfy two conditions. One is the polynomial is real when s is real. What is the other condition?
- (A) Roots of $D(s)$ have real parts which are positive and non-zero
 - (B) Roots of $D(s)$ have imaginary parts which are negative
 - (C) Roots of $D(s)$ have real parts which are either Zero or negative
 - (D) Roots of $D(s)$ have real parts which are positive or zero

Key: (C)

Exp: Conditions of Hurwitz polynomial:

1. Polynomial is real when S is real.

2. Roots of polynomial have real parts which are either negative or zero.

55. The unit impulse response of a system is given as $c(t) = -4e^{-t} + 6e^{-2t}$. The step response of the same system for $t \geq 0$ is equal to

(A) $3e^{-2t} + 4e^{-t} + 1$ (B) $-3e^{-2t} + 4e^{-t} + 1$ (C) $-3e^{-2t} + 4e^{-t} - 1$ (D) $3e^{-2t} - 4e^{-t} + 1$

Key: (C)

Exp: Given unit impulse response is

$$c(t) = -4e^{-t} + 6e^{-2t}$$

$$\therefore \text{Step response, } s(t) = \int_0^t c(t) dt$$

$$\begin{aligned} s(t) &= \int_0^t (-4e^{-t} + 6e^{-2t}) dt \\ &= 4(e^{-t})_0^t + (-3)(e^{-2t})_0^t \\ &= -3e^{-2t} + 4e^{-t} - 1 \end{aligned}$$

56. Four ammeters M_1, M_2, M_3 and M_4 with the following specifications are available. (Full scale, accuracy value as percentage of FS)

$$M_1 = 20 \pm 0.10; \quad M_2 = 10 \pm 0.20; \quad M_3 = 5 \pm 0.50; \quad \text{and} \quad M_4 = 1 \pm 1.00$$

A current of 1 A is to be measured. To obtain minimum error in the reading one should select meter.

- (A) M_1 (B) M_2 (C) M_3 (D) M_4

Key: (D)

Exp: $M_1 = 20 \pm 0.10\%$

$$M_2 = 10 \pm 0.20\%$$

$$M_3 = 5 \pm 0.50\%$$

$$M_4 = 1 \pm 1.00\%$$

Measured value is 1A.

$$\text{If } M_1 \text{ is used, error will be } \frac{20 \times 0.1}{1} \Rightarrow 2\%$$

$$\text{If } M_2 \text{ is used, error will be } \frac{10 \times 0.2}{2} \Rightarrow 2\%$$

$$\text{If } M_3 \text{ is used, error will be } \frac{5 \times 0.5}{1} \Rightarrow 2.5\%$$

M_4 minimize error.

57. In an induction type energy meter, the steady speed attained by the rotating disc is

1. Proportional to the deflecting torque.
2. Proportional to the resistance of the path of eddy currents.
3. Inversely proportional to the effective readings of disc from its axis.
4. Inversely proportional to the square of brake magnet flux.

Which of the above are correct?

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

Key: (C)

Exp: $N \propto \left(\frac{r}{\Phi^2} \right) T_D$; where $T_D =$ driving torque (braking torque is equal to driving torque when steady state speed attain)

58. Consider the following functions:

1. $\frac{(s^2 + 1)(s^2 + 3)}{s(s^2 + 2)}$

2. $\frac{s(s^2 + 1)(s^2 + 3)}{(s^2 + 0.5)(s^2 + 2)}$

3. $\frac{(s^4 + 4s^2 + 3)}{s^2 + 2s}$

4. $\frac{s^2 + 4s^3 + 3s}{s^2 + 2.5s + 1}$

Which of the above functions are LC driving point impedances?

- (A) 1, 2, 3 and 4 (B) 2 and 3 only (C) 1 and 2 only (D) 3 and 4 only

Key: (C)

59. A dc voltmeter has a sensitivity of $1000 \Omega/V$. When it measures half full scale in 100 V range, the current through the voltmeter is

- (A) 100 mA (B) 50 mA (C) 1 mA (D) 0.5 mA

Key: (D)

Exp: Sensitivity is $1000 \Omega/V$.

$$I_{fs} = \frac{1}{\text{sensitivity}} = 1 \text{ mA}$$

If measured at half scale, then the current through the voltmeter is 0.5 mA.

60. Two wattmeter method is employed to measure power in a 3-phase balanced system with the current coil connected in the A and C lines. The phase sequence is ABC. If the wattmeter with its current coil in A-phase line reads zero, then the power factor of the 3-phase load will be

- (A) Zero lagging (B) Zero leading (C) 0.5 lagging (D) 0.5 leading

Key: (C)

Exp: If one of the watt meter reads zero, then the p.f is 0.5 and it is lagging based on the phase sequence.

61. In moving iron instruments, eddy current damping cannot be used as
- (A) They have a strong operating magnetic field
 - (B) They are not normally used in vertical position
 - (C) They need a large damping force, which can only be provided by air friction.
 - (D) The introduction of a permanent magnet required for eddy current damping would distort the existing weak operating magnetic field.

Key: (D)

62. A basic D'Arsonval movement showing full scale deflection for a current of $50 \mu\text{A}$ and having internal resistance of 500Ω is used as a voltmeter. What is the value of multiplier resistance needed to measure a voltage range of 0-20 V?
- (A) 398.5 k Ω
 - (B) 399 k Ω
 - (C) 399.5 k Ω
 - (D) 400 k Ω

Key: (C)

Exp: $I_{fs} = 50\mu\text{A}$

$$R_m = 500\Omega$$

$$V_m = (50)10^{-6} \times 500 \Rightarrow 2.5 \text{ m volts}$$

$$V = 20 \text{ volts}$$

$$R_{sc} = R_m (m-1)$$

$$= 500 \left(\frac{20}{2.5 \times 10^{-3}} - 1 \right)$$

$$= 399.5 \text{ k}\Omega$$

63. One single-phase energy meter operating on 230 V and 5 A for 5 hours makes 1940 revolutions. Meter constant is 400 rev/kWh. The power factor of the load is
- (A) 1.0
 - (B) 0.8
 - (C) 0.7
 - (D) 0.6

Key: (B)

Exp: We have, no. of revolutions = meter constant \times energy,

$$\text{Energy} = VI \cos \phi \times \text{time}$$

Given,

$$\text{No. of revolutions} = 1940$$

$$\text{Meter constant} = 400 \text{ rev/kwh.}$$

$$V = 230; I = 5\text{A}; t = 5 \text{ hours.}$$

$$1940 = \frac{400}{1000} \times 230 \times 5 \times \cos \phi \times 5 \Rightarrow \cos \phi = 0.84$$

64. In De Sauty Bridge (unmodified form) it is possible to obtain balance
- (A) Even if both the capacitors are imperfect.
 (B) If one of the capacitors is perfect.
 (C) Only if both the capacitors are perfect.
 (D) All of the above.

Key: (C)

65. The current coil of a single-phase energy meter is wound on
- (A) One limb of the laminated core.
 (B) Both the limbs of the laminated core with same number of turns.
 (C) Both the limbs of the laminated core with different number of turns.
 (D) The centre of the limb on the laminated core.

Key: (B)

66. For controlling the vibration of the disc of ac energy meter, damping torque is produced by

- (A) Eddy current (B) Chemical effect
 (C) Electrostatic effect (D) Magnetic effect

Key: (A)

67. The meter constant of a single-phase 230V induction watt hour meter is 400 revolutions per kWh. The speed of the meter disc for a current of 10A of 0.9 pf lagging will be
- (A) 13.80 rpm (B) 16.02 rpm (C) 18.20 rpm (D) 21.10 rpm

Key: (A)

Exp: Energy consumed by the Load in 1 min = $\frac{VI\cos\phi}{1000} \times t$ (KWh)

$$= \frac{230 \times 10 \times 0.9}{1000} \times \frac{1}{60}$$

$$= 0.0345$$

Resolution made by the disc in 1 min = 400×0.0345

$$= 13.8 \text{ r.p.m}$$

68. A galvanometer has a current sensitivity of 1 $\mu\text{A}/\text{mm}$ and a critical damping resistance of 1k Ω . The voltage sensitivity and the meg-ohm sensitivity respectively are
- (A) 1 mV/mm and 1 M Ω (B) 1 mV/mm and 2 M Ω
 (C) 2 mV/mm and 2 M Ω (D) 2 mV/mm and 1 M Ω

Key: (A)

Exp: Voltage sensitivity = $(1 \mu\text{A}/\text{mm})1 \text{ k}\Omega$

$$= 1 \text{ mV}/\text{mm}$$

69. Electrostatic voltmeters are particularly suitable for measuring high voltages because the construction is simplified due to
- (A) Large electrostatic forces (B) Small electrostatic forces
(B) Large value of current (D) Small value of current

Key: (D)

70. A moving coil instrument of resistance 5Ω requires a potential difference of 75 mV to give a full scale deflection. The value of shunt resistance needed to give a full scale deflection at 30A is
- (A) 2.5 m Ω (B) 9.99 m Ω (C) 5 Ω (D) 9.95 Ω

Key: (A)

Exp: $R_m = 5\Omega$

$$V = 75\text{mV}$$

$$I_m = \frac{75\text{mV}}{5\Omega} \Rightarrow 15\text{mA}$$

$$R_{sh} = \frac{R_m}{\left(\frac{I}{I_m} - 1\right)} \Rightarrow \frac{5}{\left(\frac{30}{15 \times 10^{-3}} - 1\right)}$$

$$R_{sh} = 2.5\text{m}\Omega$$

71. The function of input attenuators in measuring instruments, like VTVM and CRO, is to
- (A) Increase the input impedance
(B) Attenuate the frequency range
(C) Attenuate the input signal amplitude without altering the frequency contents
(D) Attenuate the input impedances

Key: (C)

72. With the help of which bridge are the capacitance and dielectric loss of a capacitor generally measured?
- (A) De Sauty (B) Wien series (C) Anderson (D) Schering

Key: (D)

73. The deflection of a hot wire instrument depends on
- (A) Instantaneous value of alternating current
(B) Average value of current
(C) RMS value of alternating current
(D) Voltage instead of current

Key: (C)

74. A DVM uses 10 MHz clock and has a voltage controlled generator which provides a width of 5 $\mu\text{s}/\text{Volt}$ of unit signal. 10V input signal would correspond to a pulse count of
 (A) 500 (B) 750 (C) 250 (D) 1000

Key: (A)

Exp: To generate 1V, the voltage controlled generator takes 5 μs .

So far 10V, it takes 50 μsec .

Given clock frequency is $10 \times 10^6 \text{ Hz}$. $t_{\text{clk}} = 0.1 \mu \text{ sec}$

$$\therefore \text{No. of clock pulses} = \frac{50}{0.1} \Rightarrow 500$$

75. A resistance strain gauge with a gauge factor of 2.0 is fastened to a steel member subjected to a stress of 100 N/mm^2 . The modulus of elasticity of steel is approximately $2 \times 10^5 \text{ N}/\text{mm}^2$. The percentage change in resistance is
 (A) 1.50 (B) 1.00 (C) 0.15 (D) 0.10

Key: (D)

Exp: $G = \frac{\Delta R}{R} = \epsilon \text{ (strain)}$

$$\frac{\Delta R}{R} \times 100 = G \times \epsilon \times 100$$

$$\epsilon = \frac{\sigma}{E} \left(\text{strain} = \frac{\text{stress}}{\text{modulus of Elasticity}} \right)$$

$$\begin{aligned} \frac{\Delta R}{R} \times 100 &= G \times \frac{\sigma}{E} \times 100 \\ &= 2 \times \frac{100}{2 \times 10^5} \times 100 \\ &= \frac{1}{10} = 0.1 \end{aligned}$$

76. The resistances of 125 Ω strain gauge changes by 1 Ω for 4000 micro-strain. The gauge factor for strain gauge is
 (A) 1.5 (B) 2.0 (C) 2.5 (D) 3.0

Key: (B)

Exp: Gauge factor = $\left(\frac{\Delta R}{R \epsilon} \right)$

Where $\Delta R \rightarrow$ change in resistance

$R \rightarrow$ resistance of strain gauge

$\epsilon \rightarrow$ strain.

$$G = \frac{\left(\frac{1}{125}\right)}{4000 \times 10^{-6}} \Rightarrow 2.0$$

77. Delay line is essential in a CRO, to ensure that
- (A) Vertical signal starts after the retrace period of sweep signal.
 - (B) The sweep reaches the horizontal plates before the desired signal under consideration.
 - (C) Initial part of signal to be observed is not lost.
 - (D) All of the above

Key: (D)

78. Which of the following ADC has highest accuracy?
- (A) Successive approximation type
 - (B) Flash or parallel type
 - (C) Single slope integration type
 - (D) Dual slope integration type

Key: (D)

79. Consider the following transducers:

1. LVDT
2. Piezoelectric
3. Thermocouple
4. Photovoltaic cell

Which of the above are active transducers?

- (A) 1, 2 and 3
- (B) 1, 2 and 4
- (C) 2 and 3 only
- (D) 2, 3 and 4

Key: (D)

Exp: LVDT is a passive transducer.

80. A unity feedback second order control system is characterized by the open loop transfer

$$\text{function } (s) = \frac{K}{s(Js + B)}$$

J = moment of inertia, B = damping constant and K = system gain

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

- (A) Peak overshoots
- (B) Rise time
- (C) Settling time
- (D) Time to peak overshoot

Key: (C)

Exp: Given unity feedback 2nd order system,

$$T.F = \frac{K}{s(Js + B)}$$

From the given options setting (T_s), is not affected by system gain variation.

81. The dominant poles of servo-system are located at $s = (-2 \pm j2)$. The damping ratio of the system is
 (A) 1 (B) 0.8 (C) 0.707 (D) 0.6

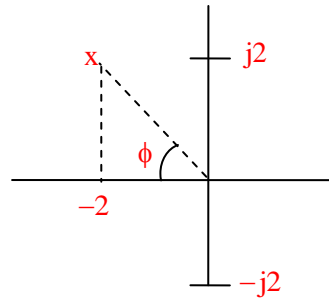
Key: (C)

Exp: Given, dominant poles, $s = -2 \pm j2$

Damping ratio $\xi = ?$

$$\therefore \xi = \cos \theta$$

$$= \frac{2}{\sqrt{4+4}} = \frac{2}{2\sqrt{2}} = \frac{1}{\sqrt{2}} = 0.707$$



82. For a unity feedback control with $G(s) = \frac{9}{s(s+3)}$, the damping ratio is

- (A) 0.5 (B) 1 (C) 0.707 (D) 0.33

Key: (A)

Exp: Given, unity feedback with $G(s) = \frac{9}{s(s+3)}$

\therefore Characteristic equation, $1+G(s) = 0$

$$\Rightarrow s^2 + 3s + 9 = 0$$

$$\therefore \omega_n = 3, 2\xi\omega_n = 3$$

$$\Rightarrow 2\xi(3) = 3$$

$$\xi = 0.5$$

83. The overall transfer function of a second order control system is given by

$$\frac{C(s)}{R(s)} = \frac{2}{s^2 + 3s + 2}$$

The time response of this system, when subjected to a unit step response is

- (A) $1 - e^{-2t} + 2e^{-t}$ (B) $1 + e^{-2t} + 2e^{-t}$ (C) $1 - 2e^{-t} + e^{-2t}$ (D) $1 + e^{-2t}$

Key: (C)

Exp: Given overall Transfer function,

$$\frac{C(s)}{R(s)} = \frac{2}{s^2 + 3s + 2}$$

Time response when subjected to unit step response is,

$$C(s) = \frac{2}{(s+1)(s+2)} \cdot \frac{1}{s}$$

$$C(s) = \frac{-2}{s+1} + \frac{1}{s+2} + \frac{1}{s}$$

$$\therefore L^{-1}\{C(s)\} = c(t) = 1 - 2e^{-t} + e^{-2t}$$

84. The position and velocity error coefficients for the system of transfer function,

$$G(s) = \frac{50}{(1+0.1s)(1+2s)} \text{ are respectively}$$

- (A) Zero and zero
- (B) Zero and infinity
- (C) 50 and zero
- (D) 50 and infinity

Key: (C)

Exp: $G(s) = \frac{50}{(1+0.1s)(1+2s)}$

Given, Position error coefficient (K_p) = $\lim_{s \rightarrow 0} G(s)$

$$K_p = \lim_{s \rightarrow 0} \frac{50}{(1+0.1s)(1+2s)} = 50$$

Velocity error coefficient (K_v) = $\lim_{s \rightarrow 0} s.G(s) = 0$

85. Consider the open-loop transfer function:

$$G(s)H(s) = \frac{5(s+1)}{s^2(s+5)(s+12)}$$

The steady-state error due to a ramp input is

- (A) 0
- (B) 5
- (C) 12
- (D) ∞

Key: (A)

Exp: Given $G(s) = \frac{5(s+1)}{s^2(s+5)(s+12)}$

e_{ss} due to a ramp input = 0 (Since type > input)

86. What will be the gain margin in dB of a system having the following open loop transfer function?

$$G(s)H(s) = \frac{2}{s(s+1)}$$

- (A) 0 (B) 2 (C) 1/2 (D) ∞

Key: (D)

Exp: Given $G(s)H(s) = \frac{2}{s(s+1)}$

Phase cross over frequency, $\omega_{pc} = ?$

$$\therefore \angle G(s)H(s) = -180$$

$$\Rightarrow -[90 + \tan^{-1}(\omega_{pc})] = -180$$

$$\Rightarrow \omega_{pc} = \infty$$

$$\therefore \text{Gain margin} = \frac{1}{|G(s)H(s)|_{\omega_{pc}}} = \frac{1}{0} = \infty$$

87. For a unit step input, a system with forward path transfer function $G(s) = \frac{20}{s^2}$ and feedback path transfer function $H(s) = (s+5)$ has a steady-state output of

- (A) 2 (B) 0.5 (C) 1 (D) 0.2

Key: (D)

Exp: Given $G(s) = \frac{20}{s^2}$

$$H(s) = (s+5)$$

$$\text{T.F} = \frac{G(s)}{1 + G(s).H(s)} = \frac{20}{s^2 + 20s + 100}$$

At steady state ; $s = 0$

$$\Rightarrow |T.F| = \frac{20}{0+0+100} = 0.2.$$

88. By adding a pole at the origin of s-plane, the Nyquist plot of a system will rotate by

- (A) 90° in anti-clockwise direction (B) 90° in clockwise direction
(C) 180° in anti-clockwise direction (D) 180° in clockwise direction

Key: (B)

Exp: When a pole is added at origin of S-plane the Nyquist plot of a system will rotate by 90° in clockwise.

89. The characteristic equation of a feedback control system is $s^4+s^3+2s^2+4s+15 = 0$. The number of roots in the right half of the s-plane is
 (A) 4 (B) 3 (C) 2 (D) 1

Key: (C)

Exp: Given characteristic equation,

$$s^4+s^3+2s^2+4s+15 = 0$$

According to R.H criteria,

$$\begin{array}{l|lll} s^4 & 1 & 2 & 15 \\ s^3 & 1 & 4 & \\ s^2 & -2 & 15 & \\ s^1 & \frac{23}{2} & & \\ s^0 & 15 & & \end{array}$$

∴ Two sign changes in the 1st column. Hence two roots in the right half of s-plane.

90. In the Bode plot of a unity feedback control system, the value of phase of $G(j\omega)$ at the gain cross-over frequency is -125° . The phase margin of the system is
 (A) -125° (B) -55° (C) 55° (D) 125°

Key: (C)

Exp: Phase margin = $180 + \angle G(j\omega) \Big|_{\omega_{gc}} = 180 + (-125) = 55^\circ$.

91. The correct sequence of steps needed to improve system stability is
 (A) Insert derivation action, use negative feedback and Reduce gain.
 (B) Reduce gain, use negative feedback and insert derivation action.
 (C) Reduce gain, insert derivation action and use negative feedback.
 (D) Use negative feedback, reduce gain and insert derivation action.

Key: (D)

Exp: The correct sequence of steps needed to improve stability is,

Use negative feedback → Reduce gain → Insert derivative control.

92. Which of the following points is not on the root locus of a system with the given open loop transfer function?

$$G(s)H(s) = \frac{K}{s(s+1)(s+3)}$$

- (A) $s = -j\sqrt{3}$ (B) $s = -1.5$ (C) $s = -3$ (D) $s = -\infty$

Key: (B)

Exp: Given, $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$

From the given options, the root locus of the system is not passing through $s = -1.5$. because substituting this value in open loop transfer function, this phase shift not equal to -180 degree Hence it is not on the RLD.

93. The effect of integral controller on the steady-state error e_{ss} and that on the relative stability R_s of the system is

- (A) Both are increased (B) e_{ss} is increased but R_s is reduced
(C) e_{ss} is reduced but R_s is increased (D) Both are reduced

Key: (D)

Exp: When an integral controller is added then both steady state error (e_{ss}) and stability of the system reduces.

94. The state equations in the phase variable canonical form can be obtained from the transfer function by

- (A) Cascade decomposition (B) Direct decomposition
(C) Inverse decomposition (D) Parallel decomposition

Key: (B)

Exp: The state equations in the phase variable canonical form can be obtained from the transfer function by Direct decomposition.

95. The transfer function of a zero order hold is given by

- (A) $\frac{1}{s}$ (B) $1-e^{-Ts}$ (C) $s(1-e^{-Ts})$ (D) $\frac{1-e^{-Ts}}{s}$

Key: (D)

Exp: The Transfer function of a zero order hold is, $\frac{1}{s} - \frac{e^{-sT}}{s} = \frac{1-e^{-sT}}{s}$

Since, $c(t) = u(t) - u(t-T)$

By Laplace $\Rightarrow C(s) = \frac{1-e^{-sT}}{s}$

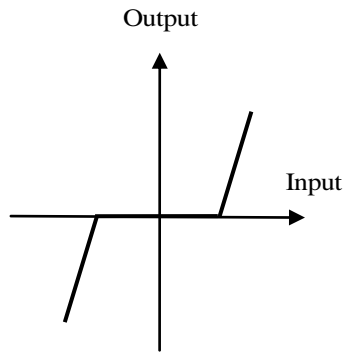
96. With negative feedback, the system stability and system gain respectively

- (A) Increases and increases (B) Increases and decreases
(C) Decreases and increases (D) Decreases and decreases

Key: (B)

Exp: By using Negative feedback, the system stability increases but the Gain decreases.

97.



This non-linearity represents

- (A) Dead zone (B) Coulomb friction
(C) Saturation (D) Hysteresis

Key: (A)

Exp: Given output and input relation indicates the dead zone of the system.

98. What is the number of turns of wire needed to provide a potentiometer with a resolution of 0.05 percent?

- (A) 200 turns (B) 2000 turns (C) 20 turns (D) 20000 turns

Key: (B)

Exp: Resolution = 0.05%

$$\text{Resolution} = \left(\frac{1}{\text{No. of turns}} \right) = \frac{1}{2000} \times 100$$

$$= 0.05$$

$$\text{No. of turns} = 2000$$

99. Consider the following properties attributed to state model of a system:

1. State model is unique.
2. Transfer function for the system is unique.
3. State model can be derived from transfer function of the system.

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)

100. A discrete time system is stable if all the roots of the characteristic equation lie

- (A) Outside the circle of unit radius
(B) Within the circle of unit radius
(C) Outside of circle of radius equal to 3 units
(D) On the circle of infinite radius

Key: (B)

Exp: A discrete time system is stable if all the roots of characteristic equation lie within the unit circle.

Directions: Each of the next **twenty (20)** items consists of two statements, one labelled as the

'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and

select the answers to these items using the codes 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 explanation of Statement (I).
- (c) Statement (I) is true but Statement (II) is false.
- (d) Statement (I) is false but Statement (II) is true.

101. Statement (I):

At 50 Hz the depth of penetration is 8.5 mm. At 30 GHz the depth of penetration is 0.00038 mm.

Statement (II):

A high frequency field attenuates as it penetrates conduction in a shorter distance than a low frequency field.

Key: (A)

102. Statement (I):

A semi-conductor is not capable of sustaining the movement of free negative electrons, but capable of positive charges or holes.

Statement (II):

The positive charges cannot be positrons because to liberate the latter, an energy as high as one million eV or more would be required.

Key: (D)

103. Statement (I):

Hard magnetic materials are used for making permanent magnets.

Statement (II):

Hard magnetic materials have relatively small and narrow hysteresis loop.

Key: (C)

Exp: Hard magnetic materials are utilized for permanent magnets, hard magnetic materials has a high remanence, a high coercivity, a high saturation flux density, high hysteresis energy losses (large hysteresis loop), and a low initial permeability.

So, Statement (II) is wrong.

104. Statement (I):

Servo motors have small diameter and large axial length.

Statement (II):

Servo motors must have low inertia and high starting torque.

Key: (A)

Exp: A dc servo motor is essentially an ordinary dc motor with minor differences in construction and characteristics. As mentioned above, the motor should have low inertia which can be obtained by reducing the armature diameter with a consequent increase in armature length.

105. Statement (I):

The magnetic moments of diamagnetic materials are mainly due to the orbital angular momentum of the electrons.

Statement (II):

A steady current flowing in the orbit produces a magnetic field equivalent to that set up by a dipole perpendicular to the plane of orbit (Ampere's law).

Key: (B)

Exp: **Statement (I):** Their diamagnetic behavior is mainly due to the distortion of the electron orbital motion by the external magnetic field.

Statement (II) is also correct, but they are not related.

106. Statement (I):

Under steady-state condition, a pure capacitor behaves as an open circuit for direct voltage.

Statement (II):

The current through a capacitor is proportional to the rate of change of voltage.

Key: (A)

107. Statement (I):

During resonance, an R-L-C series circuit behaves like a purely resistive circuit.

Statement (II):

During resonance in an R-L-C series circuit, the voltages across the L- and the C-elements are in phase to each other.

Key: (C)

Exp: During resonance the voltage across the L and C elements are not in phase to each other.
They are exactly 180° out of phase.

108. Statement (I):

The simplest method of power measurement is by means of electro dynamic type wattmeters, having two fixed coils, and one moving coil.

Statement (II):

Either of the fixed and the moving coils can be used as the current or the voltage coils.

Key: (C)

109. Statement (I):

A permanent magnet moving coil instrument is always slightly under damped.

Statement (II):

The pointer of the PMMC instrument should overshoot a little beyond the steady-state position to give the accurate reading.

Key: (A)

110. Statement (I):

Bridge measurements are considered to be more accurate as compared to measurements done indicating instruments.

Statement (II):

In a bridge measurement, the accuracy of the components used in the different arms of the bridge alone comes into picture.

Key: (A)

111. Statement (I):

RF voltage is measured by rectifying the alternating voltage first and then amplifying the resulting dc output.

Statement (II):

Amplification of RF signal itself is very difficult.

Key: (A)

112. Statement (I):

Before making any voltage measurement using electronic voltmeter, it is desirable to short circuit its input and make zero-adjustment to ensure correct reading.

Statement (II):

Drift in the dc amplifier of the electronic voltmeter may indicate output without any input voltage present.

Key: (A)

113. Statement (I):

Platinum resistance thermometers are widely used for temperature measurements for variety of industrial applications.

Statement (II):

Platinum resistance thermometers provide the highest temperature sensitivity as compared to all known temperature transducers.

Key: (A)

Exp: Among the electrical resistance thermometers, the platinum resistance thermometer is most commonly and widely used because thermometer works very accurately within the range from -253 to 1200°C .

114. Statement (I):

Flash analog-to-digital conversion is the fastest but an expensive method for designing ADCs.

Statement (II):

Flash analog-to-digital converters are employed on very high speed digital acquisition systems.

Key: (B)

115. Statement (I):

Transfer function approach is inadequate, when time domain solution is required.

Statement (II):

All initial conditions of the system are neglected in derivation of transfer function.

Key: (A)

Exp: (I). Transfer function approach is inadequate, when time domain solution is required.
(II). During Derivation of Transfer function, the initial conditions of system are considered as zero.

116. Statement (I):

The polar plot has limitation for portraying the frequency response of a system.

Statement (II):

The calculation of frequency response is tedious and does not indicate the effect of the individual poles and zeros.

Key: (D)

Exp: Statement (I): Polar plot does not have limitation for portraying the frequency response of a system.

Statement (II): The calculation of frequency response is tedious and does not indicate the effect of individual poles and zeros.

117. Statement (I):

A large resonance peak in frequency response also corresponds to a large peak overshoot in transient response.

Statement (II):

All the systems which exhibit overshoot in time response will also exhibit resonance peak in frequency response.

Key: (C)

Exp: Statement (I) is true since resonance peak in frequency response corresponds to a large peak overshoot in transient response.

Statement (II) is false since, many systems are designed to exhibit resonance peak in the range of $\xi = 1.2$ to 1.4 .

118. Statement (I):

The state feedback design is more realistic than conventional fixed configuration controller design.

Statement (II):

The disadvantage with the state feedback is that all the states must be sensed and fed back for control.

Key: (A)

Exp: Statement (I): The state feedback design is more realistic than conventional fixed configuration controller design.

Statement (II): But the drawback is all the states of a system must be sensed and fed back for control.

119. Statement (I):

For radar tracking systems, signals are available in the form of pulse trains.

Statement (II):

The stability of a discrete-time system is decreased as the sampling period is shortened.

Key: (C)

120. Statement (I):

Soft magnetic materials are not used in the construction of permanent magnets.

Statement (II):

Soft magnetic materials have narrow hysteresis loop, low retentivity and low coercivity.

Key: (A)

Exp: Soft magnetic material, on the other hand, has a high initial permeability, a low coercivity, and low hysteresis energy losses. Hence it is not used as permanent magnetic.