ELECTRIC CIRCUITS/NETWORK ANALYSIS- MODEL QUESTIONS

Q.1 To calculate Thevenin's equivalent value in a circuit

(A) all independent voltage sources are opened and all independent current sources are short circuited.

(B) both voltage and current sources are open circuited

(C) all voltage and current sources are shorted.

(D) all voltage sources are shorted while current sources are opened.

Ans: D

To calculate Thevenin's equivalent impedance value in a circuit, all independent voltage sources are shorted while all independent current sources are opened.

Q.2 A 26 dBm output in watts equals to

(A) 2.4W. (B) 0.26W. (C) 0.156W. (D) 0.4W.

Ans: A

A 26dBm output in watts equals to 0.4 W because

$10*\log_{10}(400MW/1MW) = 26DB$

Q.3 The Characteristic Impedance of a low pass filter in attenuation Band is

(A) Purely imaginary. (B) Zero. (C) Complex quantity. (D) Real value.

Ans: A

The characteristic impedance of a low pass filter in attenuation band is purely imaginary.

Q.4 The real part of the propagation constant shows:

(A) Variation of voltage and current on basic unit.

(B) Variation of phase shift/position of voltage.

(C) Reduction in voltage, current values of signal amplitude.

(D) Reduction of only voltage amplitude.

Ans: C

The real part of the propagation constant shows reduction in voltage, current values of signal amplitude.

Q.5 The purpose of an Attenuator is to:

(A) increase signal strength.

(B) provide impedance matching.

(C) decrease reflections.

(D) decrease value of signal strength.

Ans: D

The purpose of an Attenuator is to decrease value of signal strength.

Q.7 In a transmission line terminated by characteristic impedance, Z_O

(A) There is no reflection of the incident wave.

(B) The reflection is maximum due to termination.

(C) There are a large number of maximum and minimum on the line.

(D) The incident current is zero for any applied signal.

Ans: A

In a transmission line terminated by characteristic impedance, Zo there is no reflection of the incident wave.

Q.8 For a coil with inductance L and resistance R in series with a capacitor C has

(A) Resonance impedance as zero.

(B) Resonance impedance R.

(C) Resonance impedance L/CR.

(D) Resonance impedance as infinity.

Ans: B

For a coil with inductance L and resistance R in series with a capacitor C has a resonance impedance R.

Q.9 Laplace transform of a unit Impulse function is

(A)s.   (B) 0.   (C) e^{-S} (D) 1.

Ans: D

Laplace transform of a unit Impulse function is 1

Q.10 Millman's theorem is applicable during determination of

(A) Load current in a network of generators and impedances with two output terminals.

(B) Load conditions for maximum power transfer.

(C) Dual of a network.

(D) Load current in a network with more than one voltage source.

Ans: D

Millman's theorem is applicable during determination of Load current in a network with more than one voltage source.

Q.12 An attenuator is a

(A) R's network.   (B) RL network.   (C) RC network.   (D) LC network.

Ans: A

An attenuator is a R's network.

Q.13 A pure resistance, R_L when connected at the load end of a loss-less 100 Ω line produces a VSWR of 2. Then R is

(A) 50 Ω only.   (B) 200 Ω only.   (C) 50 Ω or 200 Ω.   (D) 400 Ω.

Ans: C

A pure resistance, R_L when connected at the load end of a loss-less 100 Ωline produces a VSWR of 2. Then R_L is 50 Ω or 200 Ω, as follows:

Q.14 All pass filter

(A) passes whole of the audio band.

(B) passes whole of the radio band.

(C) passes all frequencies with very low attenuation.

(D) passes all frequencies without attenuation but phase is changed.

Ans: D

All pass filters, passes all frequencies without attenuation but phase change.

Q.16 A series resonant circuit is inductive at f = 1000 Hz. The circuit will be capacitive some where at

(A) $f > 1000$ Hz.

(B) $f < 1000$ Hz.

(C) f equal to 1000 Hz and by adding a resistance in series.

(D) $f = 1000 + f_O$ (resonance frequency)

Ans: B

A series resonant circuit is inductive at f = 1000 Hz. The circuit will be capacitive some where at $f < 1000$ Hz.

Q.17 Compensation theorem is applicable to

(A) non-linear networks. (B) linear networks. (C) linear and non-linear networks. (D) None of the above.

Ans: C

Compensation theorem is applicable to linear and non-linear networks.

Q.19 A network function is said to have simple pole or simple zero if

(A) the poles and zeroes are on the real axis.

(B) the poles and zeroes are repetitive.

(C) the poles and zeroes are complex conjugate to each other.

(D) the poles and zeroes are not repeated.

Ans: D

A network function is said to have simple pole or simple zero if the poles and zeroes are not repeated.

Q.20 A delta connection contains three impedances of 60 Ω each. The impedances of equivalent star connection will be

(A) 15 Ωeach. (B) 20 Ω each. (C) 30 Ω each. (D) 40 Ω each.

Ans: B A delta connection contains three impedances of 60Ω each. The impedances of equivalent star connection will be 20Ω each.

Q.21 Millman theorem yields

(A) equivalent resistance of the circuit.

(B) equivalent voltage source.

(C) equivalent voltage OR current source.

(D value of current in milli amperes input to a circuit from a voltage source.

Ans: C

Millman's theorem yields equivalent voltage or current source.

Q.22 The z-parameters of the shown T-network at Fig.1 are given by

(A) 5, 8, 12, 0

(B) 13, 8, 8, 20

(C) 8, 20, 13, 12

(D) 5, 8, 8, 12

Q.23 The "Superposition theorem" is essentially based on the concept of

(A) duality. (B) linearity. (C) reciprocity. (D) non-linearity.

Ans: B

Q.24 The power factor of a purely resistive circuit is

(A) zero. (B) unity. (C) lagging. (D) leading.

Ans: B

Q.1 The two windings of a transformer is
(A)   conductively linked.
(B) inductively linked.
(C) not linked at all.
(D) electrically linked.
Ans : B

Q.2 A salient pole synchronous motor is running at no load. Its field current is switched off. The motor will
(A) come to stop.
(B) continue to run at synchronous speed.
(C) continue to run at a speed slightly more than the synchronous speed.
(D) continue to run at a speed slightly less than the synchronous speed.
Ans: B

Q.3 The d.c. series motor should always be started with load because
(A) at no load, it will rotate at dangerously high speed.
(B) it will fail to start.
(C) it will not develop high starting torque.
(D) all are true.
Ans: A

Q.4 The frequency of the rotor current in a 3 phase 50 Hz, 4 pole induction motor at full load speed is about
(A) 50 Hz.
(B) 20 Hz.
(C) 2 Hz.
(D) Zero.
Ans: C

Q.5 In a stepper motor the angular displacement
(A) can be precisely controlled.
(B) it cannot be readily interfaced with micro computer based controller.
(C) the angular displacement cannot be precisely controlled.
(D) it cannot be used for positioning of work tables and tools in NC machines.
Ans: A
Q.6 The power factor of a squirrel cage induction motor is
(A) low at light load only.
(B) low at heavy load only.
(C) low at light and heavy load both.
(D) low at rated load only.

Ans: A

Q.7 The generation voltage is usually
(A) between 11 KV and 33 KV.
(B) between 132 KV and 400 KV.
(C) between 400 KV and 700 KV.
(D) None of the above.
Ans: A

Q.8 When a synchronous motor is running at synchronous speed, the damper winding produces
(A) damping torque.
(B) eddy current torque.
(C) torque aiding the developed torque.
(D) no torque.
Ans: D

Q.9 If a transformer primary is energised from a square wave voltage source, its output voltage will be
(A) A square wave.
(B) A sine wave.
(C) A triangular wave.
(D) A pulse wave.
Ans: A

Q.10 In a d.c. series motor the electromagnetic torque developed is proportional to
(A) I_a
(B) $(I_a)^2$
(C) $1/I_a$
(D) $1/(I_a)^2$
Ans: B

Q.11 In a 3 – phase induction motor running at slip 's' the mechanical power developed in terms of air gap power
(A) $(s-1)P_g$
(B) $P_g/(1-s)$
(C) $(1-s)P_g$
(D) $s.P_g$
Ans: C

Q.12 In a 3 – phase induction motor the maximum torque
(A) is proportional to rotor resistance r_2
(B) does not depend on r_2
(C) is proportional to sqrt(r_2)
(D) is proportional to $(r_2)^2$
Ans: B

Q.13 In a d.c. machine, the armature mmf is
(A) stationary w.r.t. armature.
(B) rotating w.r.t. field.
(C) stationary w.r.t. field.
(D) rotating w.r.t. brushes.
Ans: C

Q.14 In a transformer the voltage regulation will be zero when it operates at
(A) unity p.f.
(B) leading p.f.
(C) lagging p.f.
(D) zero p.f. leading.
Ans: B

Q.15 The maximum power in cylindrical and salient pole machines is obtained respectively at load angles of
(A) $90^0, 90^0$
(B) $<90^0, 90^0$
(C) $90^0, >90^0$
(D) $90^0, <90^0$
Ans: D

Q.16 The primary winding of a 220/6 V, 50 Hz transformer is energised from 110 V, 60 Hz supply. The secondary output voltage will be
(A) 3.6 V.
(B) 2.5 V.
(C) 3.0 V.
(D) 6.0 V.
Ans: C

Q.17 The emf induced in the primary of a transformer
(A) is in phase with the flux.
(B) lags behind the flux by 90 degree.
(C) leads the flux by 90 degree.
(D) is in phase opposition to that of flux.
Ans: C

Q.18 The relative speed between the magnetic fields of stator and rotor under steady state operation is zero for a
(A) dc machine.
(B) 3 phase induction machine.
(C) synchronous machine.
(D) single phase induction machine.
Ans: all options are correct

Q.19 The current from the stator of an alternator is taken out to the external load circuit through
(A) slip rings.
(B) commutator segments.
(C) solid connections.
(D) carbon brushes.
Ans: C

Q.20 A motor which can conveniently be operated at lagging as well as leading power factors is the
(A) squirrel cage induction motor.
(B) wound rotor induction motor.
(C) synchronous motor.
(D) DC shunt motor.
Ans: C

Q.21 A hysteresis motor
(A) is not a self-starting motor.
(B) is a constant speed motor.
(C) needs dc excitation.
(D) can not be run in reverse speed.
Ans: B

Q.22 The most suitable servomotor for low power applications is
(A) a dc series motor.
(B) a dc shunt motor.
(C) an ac two-phase induction motor.
(D) an ac series motor.
Ans: B
Q.23 The size of a conductor used in power cables depends on the
(A) operating voltage. *(B) power factor.*
(C) current to be carried. *(D) type of insulation used.Ans: C*
Q.24 Out of the following methods of heating the one which is independent of supply frequency is

(A) electric arc heating *(B) induction heating* *(C) electric resistance heating* *(D) dielectric heating*

Ans: C

Q.25 A two-winding single phase transformer has a voltage regulation of 4.5% at full-load and unity power-factor. At full-load and 0.80 power-factor lagging load the voltage regulation will be

(A) 4.5%. *(B) less than 4.5%.* *(C) more than 4.5%.* *(D) 4.5% or more than 4.5%.*

Ans: C

Q.26 In a dc shunt motor the terminal voltage is halved while the torque is kept constant. The resulting approximate variation in speed " ω" and armature current "I_a'" will be
(A) Both ω and I_a are doubled.
(B) ω is constant and I_a is doubled
(C) w is doubled while I_a is halved
(D) w is constant but I_a is halved
Ans: B

Q.27 A balanced three-phase, 50 Hz voltage is applied to a 3 phase, 4 pole, induction motor. When the motor is delivering rated output, the slip is found to be 0.05. The speed of the rotor m.m.f. relative to the rotor structure is
(A) 1500 r.p.m.
(B) 1425 r.p.m.
(C) 25 r.p.m.
(D) 75 r.p.m.
Ans: D

Q.28 An alternator is delivering rated current at rated voltage and 0.8 power-factor lagging case. If it is required to deliver rated current at rated voltage and 0.8 power-factor leading, the required excitation will be
(A) less.
(B) more.
(C) more or less.
(D) the same.
Ans: B

Q.29 A ceiling fan uses
(A) split-phase motor.
(B) capacitor start and capacitor run motor.
(C) universal motor.
(D) capacitor start motor.
Ans: D

Q.30 A stepper motor is
(A) a dc motor. (B) a single-phase ac motor. (C) a multi-phase motor. (D) a two phase motor.
Ans: D

Q.31 The 'sheath' is used in cable to
(A) provide strength to the cable.
(B) provide proper insulation.
(C) prevent the moisture from entering the cable.
(D) avoid chances of rust on strands.
Ans: A

Q.32 The drive motor used in a mixer-grinder is a
(A) dc motor. (B) induction motor. (C) synchronous motor. (D) universal motor.
*Ans: D*Q.33 *A 1:5 step-up transformer has 120V across the primary and 600 ohms resistance across the secondary. Assuming 100% efficiency, the primary current equals(A) 0.2 Amp. (B) 5 Amps. (C) 10 Amps. (D) 20 Amps.*

Ans: A

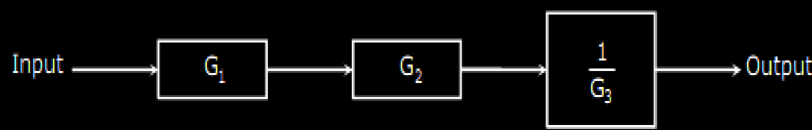
Q.34 A dc shunt generator has a speed of 800 rpm when delivering 20 A to the load at the terminal voltage of 220V. If the same machine is run as a motor it takes a line current of 20A from 220V supply. The speed of the machine as a motor will be
(A) 800 rpm. (B) more than 800 rpm. (C) less than 800 rpm. (D) both higher or lower than 800 rpm.
Ans: C

Q.35 A 50 Hz, 3-phase induction motor has a full load speed of 1440 r.p.m. The number of poles of the motor are
(A) 4. (B) 6. (C) 12. (D) 8.
Ans: A

1. The pressure coil of a dynamometer type wattmeter is

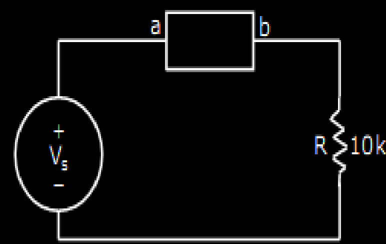
(A) highly inductive
(B) highly resistive
(C) purely resistive
(D) purely inductive

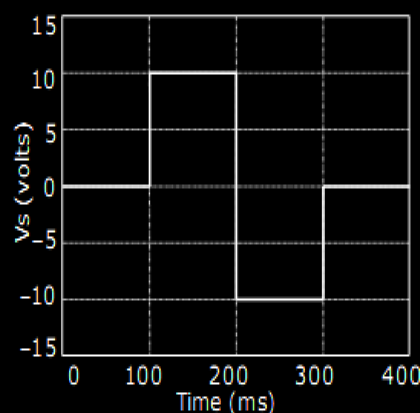
2. The measurement system shown in the figure uses three sub-systems in cascade whose gains are specified as G_1, G_2 and $\frac{1}{G_3}$. The relative small errors associated with each respective subsystem G_1, G_2 and G_3 are $\varepsilon_1, \varepsilon_2$ and ε_3. The error associated with the output is:

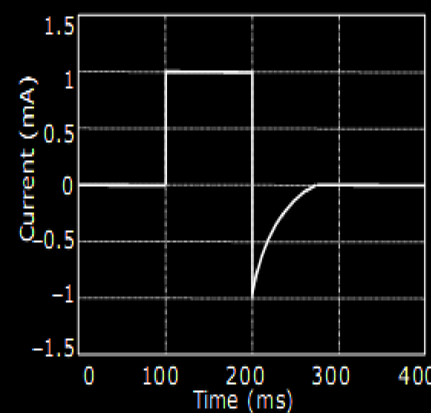


(A) $\varepsilon_1 + \varepsilon_2 + \frac{1}{\varepsilon_3}$
(B) $\frac{\varepsilon_1 . \varepsilon_2}{\varepsilon_3}$
(C) $\varepsilon_1 + \varepsilon_2 - \varepsilon_3$
(D) $\varepsilon_1 + \varepsilon_2 + \varepsilon_3$

3. The following circuit has a source voltage V_s as shown in the graph. The current through the circuit is also shown.





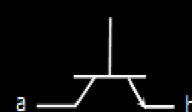


The element connected between a and b could be

(A) 

(B) 

(C) 

(D) 

4. The two inputs of a CRO are fed with two stationary periodic signals. In the X-Y mode, the screen shows a figure which changes from ellipse to circle and back to ellipse with its major axis changing orientation slowly and repeatedly. The following inference can be made from this.

(A) The signals are not sinusoidal

(B) The amplitudes of the signals are very close but not equal

(C) The signals are sinusoidal with their frequencies very close but not equal

(D) There is a constant but small phase difference between the signals

5. The increasing order of speed of data access for the following devices is

(i) Cache Memory

(ii) CDROM

(iii) Dynamic RAM

(iv) Processor Registers

(v) Magnetic Tape

(A) (v), (ii), (iii), (iv), (i)

(B) (v), (ii), (iii), (i), (iv)

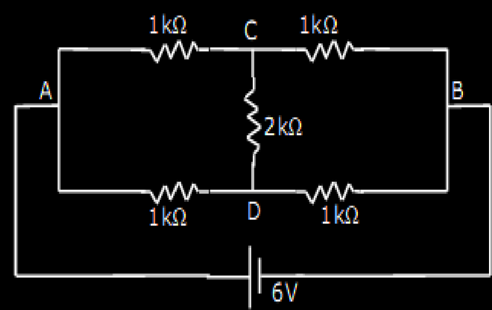
(C) (ii), (i), (iii), (iv), (v)

(D) (v), (ii), (i), (iii), (iv)

6. A field excitation of 20 A in a certain alternator results in an armature current of 400A in short circuit and a terminal voltage of 2000V on open circuit. The magnitude of the internal voltage drop within the machine at a load current of 200A is

(A) 1V (B) 10V (C) 100V (D) 1000V

7. The current through the 2 kΩ resistance in the circuit shown is



(A) 0mA (B) 1mA (C) 2mA (D) 6mA

8. Out of the following plant categories

(i) Nuclear (ii) Run-of-river (iii) Pump Storage (iv)Diesel

The base load power plants are

(A) (i) and (ii) (B) (ii) and (iii) (C) (i), (ii) and (iv) (D) (i), (iii) & (iv)

9. For a fixed value of complex power flow in a transmission line having a sending end voltage V, the real power loss will be proportional to

(A) V (B) V^2 (C) $1/V^2$ (D) 1/V

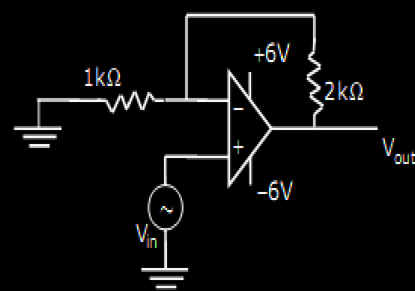
10. How many 200W/220V incandescent lamps connected in series would consume the same total power as a single 100W/220V incandescent lamp?

(A) not possible (B) 4 (C) 3 (D) 2

11. A Linear Time Invariant system with an impulse response h(t) produces output y(t) when input x(t) is applied. When the input $x(t-\tau)$ is applied to a system with impulse response $h(t-\tau)$, the output will be

(A) $y(t)$ (B) $y(2(t-\tau))$ (C) $y(t-\tau)$ (D) $y(t-2\tau)$

12. The nature of feedback in the opamp circuit shown is



(A) Current - Current feedback

(B) Voltage - Voltage feedback

(C) Current - Voltage feedback

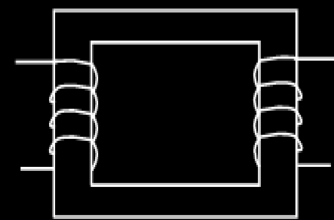
(D) Voltage - Current feedback

13. The complete set of only those Logic Gates designated as Universal Gates is

(A) NOT, OR and AND Gates (B) XNOR, NOR and NAND Gate

(C) NOR and NAND Gates (D) XOR, NOR and NAND Gates

14. The single phase, 50Hz, iron core transformer in the circuit has both the vertical arms of cross sectional area $20cm^2$ and both the horizontal arms of cross sectional area $10cm^2$. If the two windings shown were wound instead on opposite horizontal arms, the mutual inductance will



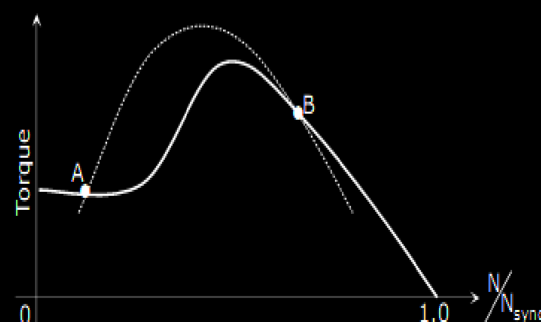
(A) double

(B) remain same

(C) be halved

(D) become one quarter

15. A 3-phase squirrel cage induction motor supplied from a balanced 3-phase source drives a mechanical load. The torque-speed characteristics of the motor (solid curve) and of the load (dotted curve) are shown. Of the two equilibrium points A and B, which of the following options correctly describes the stability of A and B?



(A) A is stable B is unstable

(B) A is unstable B is stable

(C) Both are stable

(D) Both are unstable

16. An SCR is considered to be a semi-controlled device because

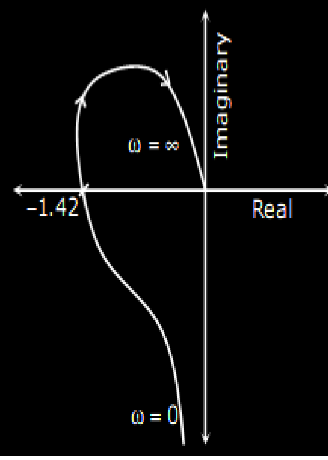
(A) it can be turned OFF but not ON with a gate pulse

(B) it conducts only during one half-cycle of an alternating current wave

(C) it can be turned ON but not OFF with a gate pulse

(D) it can be turned ON only during one half-cycle of an alternating voltage wave

17. The polar plot of an open loop stable system is shown below. The closed loop system is



(A) Always stable

(B) Marginally stable

(C) Unstable with one pole on the RH s-plane

(D) Unstable with two poles on the RH s-plane

18. The first two rows of Routh's tabulation of a third order equation are as follows.

$\begin{matrix} s^3 & 2 & 2 \\ s^2 & 4 & 4 \end{matrix}$. This means there are

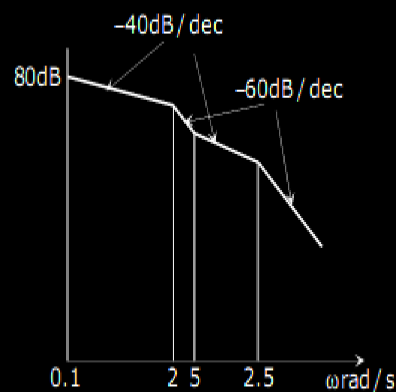
(A) two roots at $s = \pm j$ and one root in right half s-plane

(B) two roots at $s = \pm j2$ and one root in left half s-plane

(C) two roots at $s = \pm j2$ and one root in right half s-plane

(D) two roots at $s = \pm j$ and one root in left half s-plane

19. The asymptotic approximation of the log-magnitude vs frequency plot of a system containing only real poles and zeros is shown. Its transfer function is

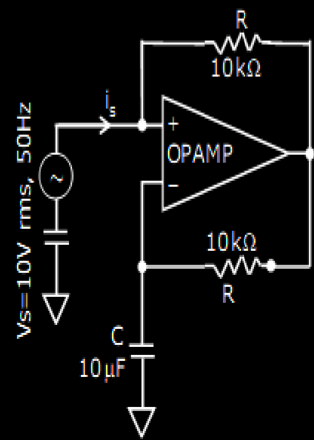


(A) $\frac{10(s+5)}{s(s+2)(s+25)}$ (B) $\frac{1000(s+5)}{s^2(s+2)(s+25)}$ (C) $\frac{100(s+5)}{s(s+2)(s+25)}$ (D) $\frac{80(s+5)}{s^2(s+2)(s+25)}$

20. The trace and determinant of a 2×2 matrix are known to be -2 and -35 respectively. Its eigen values are

(A) -30 and -5 (B) -37 and -1 (C) -7 and 5 (D) 17.5 and -2

21. The following circuit has $R = 10k\Omega$, $C = 10\mu F$ R. The input voltage is a sinusoid at 50Hz with an rms value of 10V. Under ideal conditions, the current i_s from the source is



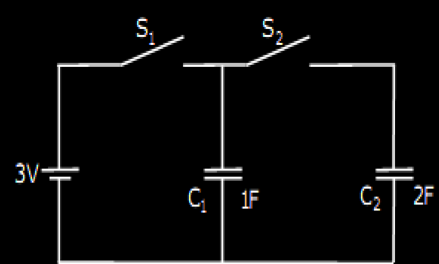
(A) 10πmA leading by 90^0

(B) 20πmA leading by 90^0

(C) 10 mA leading by 90^0

(D) 10πmA lagging by 90^0

22. In the figure shown, all elements used are ideal. For time t<0, S_1 remained closed and S_2 open. At t=0, S_1 is opened and S_2 is closed. If the voltage V_{c2} across the capacitor C_2 at t=0 is zero, the voltage across the capacitor combination at $t=0^+$ will be



(A) 1V (B) 2 V (C) 1.5 V (D) 3 V

23. Transformer and emitter follower can both be used for impedance matching at the output of an audio amplifier. The basic relationship between the input power P_{in} and output power P_{out} in both the cases is

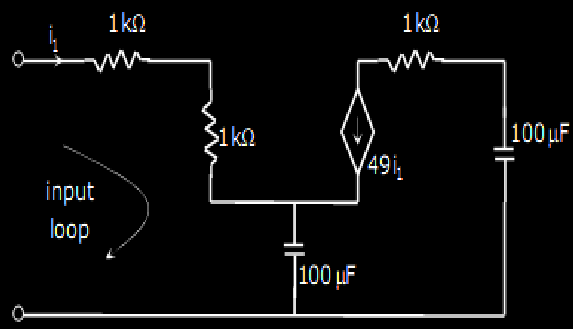
(A) $P_{in} = P_{out}$ for both transformer and emitter follower

(B) $P_{in} > P_{out}$ for both transformer and emitter follower

(C) $P_{in} < P_{out}$ for transformer and $P_{in} = P_{out}$ for emitter follower

(D) $P_{in} = P_{out}$ for transformer and $P_{in} < P_{out}$ for emitter follower

24. The equivalent capacitance of the input loop of the circuit shown is



(A) 2μF (B) 100μF (C) 200 μF (D) 4 μF

25. In an 8085 microprocessor, the contents of the Accumulator, after the following instructions are executed will become

XRA A
MVIB F0H
SUB B

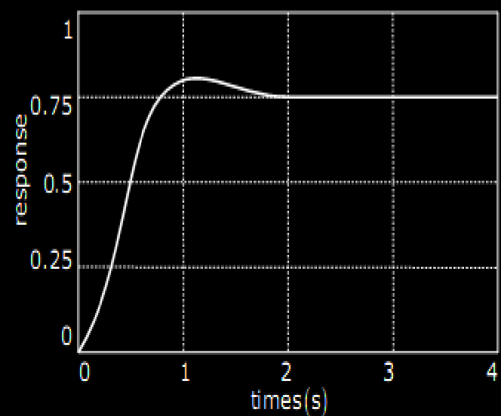
(A) 01 H (B) 0F H (C) F0 H (D) 10 H

26. For the Y-bus matrix of a 4-bus system given in per unit, the buses having shunt elements are

$$Y_{BUS} = j\begin{bmatrix} -5 & 2 & 2.5 & 0 \\ 2 & -10 & 2.5 & 4 \\ 2.5 & 2.5 & -9 & 4 \\ 0 & 4 & 4 & -8 \end{bmatrix}$$

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

27. The unit-step response of a unity feedback system with open loop transfer function G(s) = K/ ((s + l) (s + 2)) is shown in the figure. The value of K is



(A) 0.5 (B) 2 (C) 4 (D) 6

28. The open loop transfer function of a unity feedback system is given by $G(s) = \left(e^{-0.1s}\right)/s$. The gain margin of this system is

(A) 11.95dB (B) 17.67dB (C) 21.33dB (D 23.9dB

29. Match the items in List-I with the items in List-II and select the correct answer using the codes given below the lists.

List I	**List II**
To	Use
a. improve power factor	1. shunt reactor
b. reduce the current ripples	2. shunt capacitor
c. increase the power flow in line	3. series capacitor
d. reduce the Ferranti effect	4. series reactor

(A) $a \to 2$ $b \to 3$ $c \to 4$ $d \to 1$

(B) $a \to 2$ $b \to 4$ $c \to 3$ $d \to 1$

(C) $a \to 4$ $b \to 3$ $c \to 1$ $d \to 2$

(D) $a \to 4$ $b \to 1$ $c \to 3$ $d \to 2$

30. Match the items in List-I with the items in List-II and select the correct answer using the codes given below the lists.

List I	**List II**
Type of transmission line	**Type of distance relay preferred**
a. Short Line	1. Ohm Relay
b. Medium Line	2. Reactance Relay
c. Long Line	3. Mho Relay

(A) $a \to 2$ $b \to 1$ $c \to 3$

(B) $a \to 3$ $b \to 2$ $c \to 1$

(C) $a \to 1$ $b \to 2$ $c \to 3$

(D) $a \to 1$ $b \to 3$ $c \to 2$

31. Three generators are feeding a load of 100MW. The details of the generators are

	Rating(MW)	Efficiency (%)	Regulation (p.u.) on 100 MVA base
Generator-1	100	20	0.02
Generator-2	100	30	0.04
Generator-3	100	40	0.03

In the event of increased load power demand, which of the following will happen?

(A) All the generators will share equal power

(B) Generator-3 will share more power compared to Generator-1

(C) Generator-1 will share more power compared to Generator-2

(D) Generator-2 will share more power compared to Generator-3

32. A 500MW, 21kV,, 50Hz, 3-phase, 2-pole synchronous generator having a rated p.f=0.9, has a moment of inertia of 27.5 x 10^3 kg-m^2. The inertia constant (H) will be

(A) 2.44s (B) 2.71s (C) 4.88s (D) 5.42s

33. f(x,y) is a continuous function defined over $(x,y) \in [0,1] \times [0,1]$. Given the two constraints, $x>y^2$ and $y>x^2$, the volume under f(x,y) is

(A) $\int_{y=0}^{y=1} \int_{x=y^2}^{x=\sqrt{y}} f(x,y)\,dxdy$

(B) $\int_{y=x^2}^{y=1} \int_{x=y^2}^{x=1} f(x,y)\,dxdy$

(C) $\int_{y=0}^{y=1} \int_{x=0}^{x=1} f(x,y)\,dxdy$

(D) $\int_{y=0}^{y=\sqrt{x}} \int_{x=0}^{x=\sqrt{y}} f(x,y)\,dxdy$

34. Assume for simplicity that N people, all born in April (a month of 30 days), are collected in a room. Consider the event of at least two people in the room being born on the same date of the month, even if in different years, e.g. 1980 and 1985. What is the smallest N so that the probability of this event exceeds 0.5?

(A) 20 (B) 7 (C) 15 (D) 16

35. A cascade of 3 Linear Time Invariant systems is causal and unstable. From this, we conclude that

(A) Each system in the cascade is individually causal and unstable

(B) At least one system is unstable and at least one system is causal

(C) At least one system is causal and all systems are unstable

(D) The majority are unstable and the majority are causal

36. The Fourier Series coefficient, of a periodic signal x(t), expressed as

$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{j2\pi kt/T}$ are given by

$a_{-2} = 2 - j1$; $a_{-1} = 0.5 + j0.2$; $a_0 = j2$; $a_1 = 0.5 - j0.2$; $a_2 = 2 + j1$; and

$a_k = 0$; for $|k| > 2$. Which of the following is true?

36. The Fourier Series coefficient, of a periodic signal x(t), expressed as

$x(t)=\sum_{k=-\infty}^{\infty} a_k e^{j2\pi kt/T}$ are given by

$a_{-2}=2-j1;\ a_{-1}=0.5+j0.2;\ a_0=j2;\ a_1=0.5-j0.2;\ a_2=2+j1;$ and

$a_k=0;$ for $|k|>2$. Which of the following is true?

(A) x(t) has finite energy because only finitely many coefficients are non-zero

(B) x(t) has zero average value because it is periodic

(C) The imaginary part of x(t) is constant

(D) The real part of x(t) is even

37. The z-transform of a signal $x[n]$ is given by $4z^{-3}+3z^{-1}+2-6z^{2}+2z^{3}$. It is applied to a system, with a transfer function $H(z)=3z^{-1}-2$. Let the output be y(n). Which of the following is true?

(A) y(n) is non causal with finite support

(B) y(n) is causal with infinite support

(C) $y(n) = 0; |n|>3$

(D) $\mathrm{Re}[Y(z)]_{z=e^{j\theta}}=-\mathrm{Re}[Y(z)]_{z=e^{-j\theta}};\ \mathrm{Im}[Y(z)]_{z=e^{j\theta}}=\mathrm{Im}[Y(z)]_{z=e^{-j\theta}};\ -\pi\le\theta<\pi$

38. A cubic polynomial with real coefficients

(A) can possibly have no extrema and no zero crossings

(B) may have up to three extrema and up to 2 zero crossings

(C) cannot have more than two extrema and more than three zero crossings

(D) will always have an equal number of extrema and zero crossings

39. Let x^2 -117 = 0. The iterative steps for the solution using Newton-Raphson's method is given by

(A) $x_{k+1} = \frac{1}{2}\left(x_k + \frac{117}{x_k}\right)$

(B) $x_{k+1} = x_k - \frac{117}{x_k}$

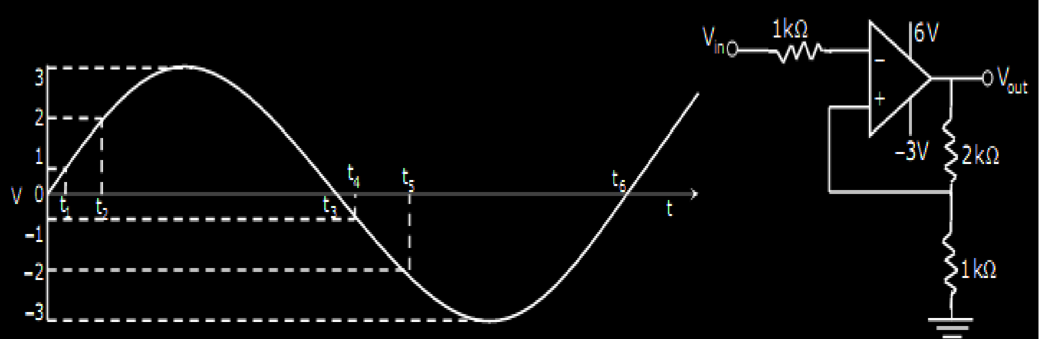
(C) $x_{k+1} = x_k - \frac{x_k}{117}$

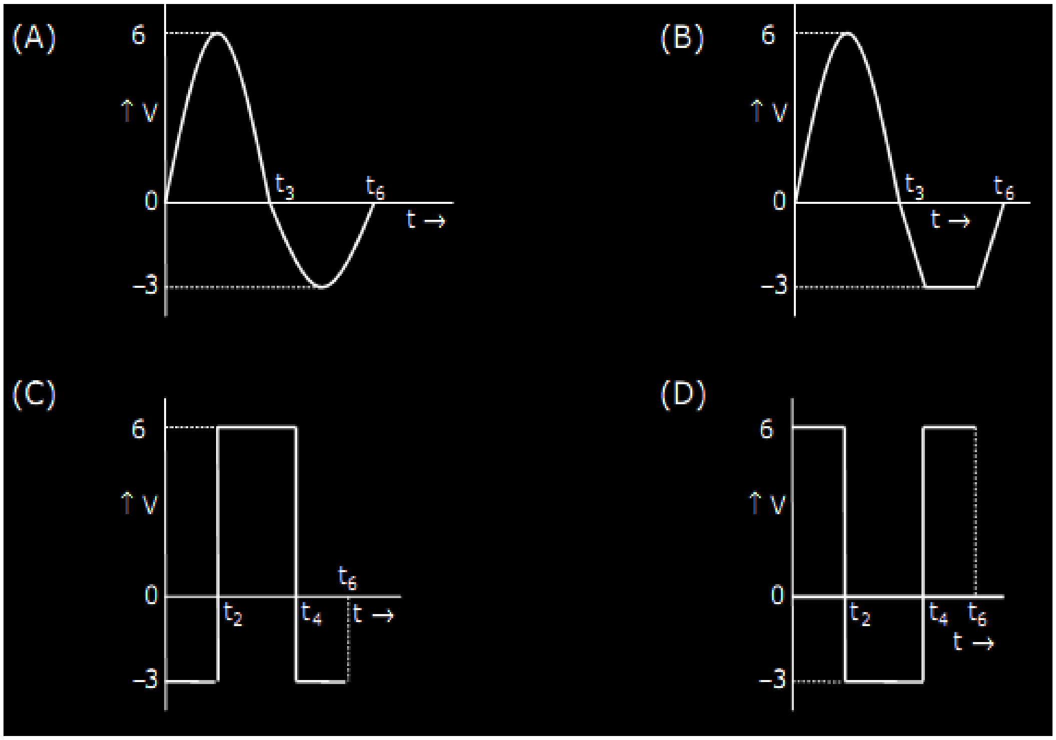
(D) $x_{k+1} = x_k - \frac{1}{2}\left(x_k + \frac{117}{x_k}\right)$

40. $F(x,y) = (x^2 + xy)\hat{a}_x + (y^2 + xy)\hat{a}_y$. It's line integral over the straight line from (x,y)= (0,2) to (x,y) = (2,0) evaluates to

(A) -8 (B) 4 (C) 8 (D) 0

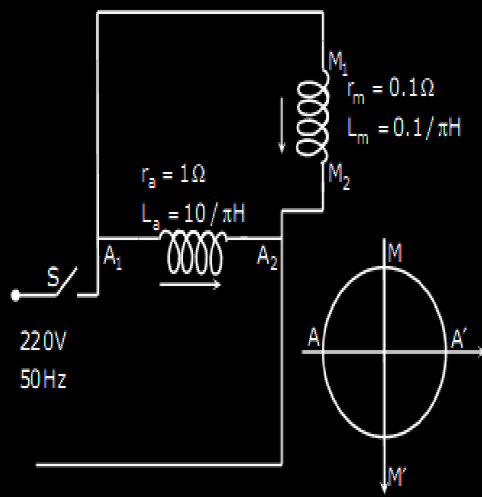
41. An ideal opamp circuit and its input waveform are shown in the figures. The output waveform of this circuit will be





(A)
6
↑ V
0
–3
t_3
t_6
t →
(B)
6
↑ V
0
–3
t_3
t_6
t →
(C)
6
↑ V
0
–3
t_2
t_4
t_6
t →
(D)
6
↑ V
0
–3
t_2
t_4
t_6
t →

42. A 220V, 50Hz, single-phase induction motor has the following connection diagram and winding orientations shown. MM' is the axis of the main stator winding (M_1M_2) and AA' is that of the auxiliary winding (A_1A_2). Directions of the winding axes indicate direction of flux when currents in the windings are in the directions shown. Parameters of each winding are indicated. When switch S is closed, the motor



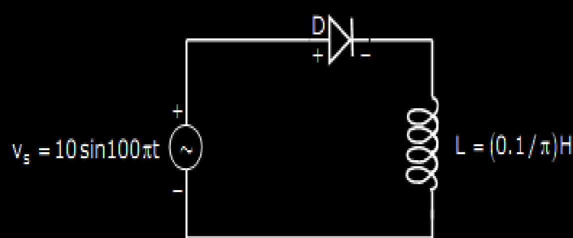
(A) rotates clockwise

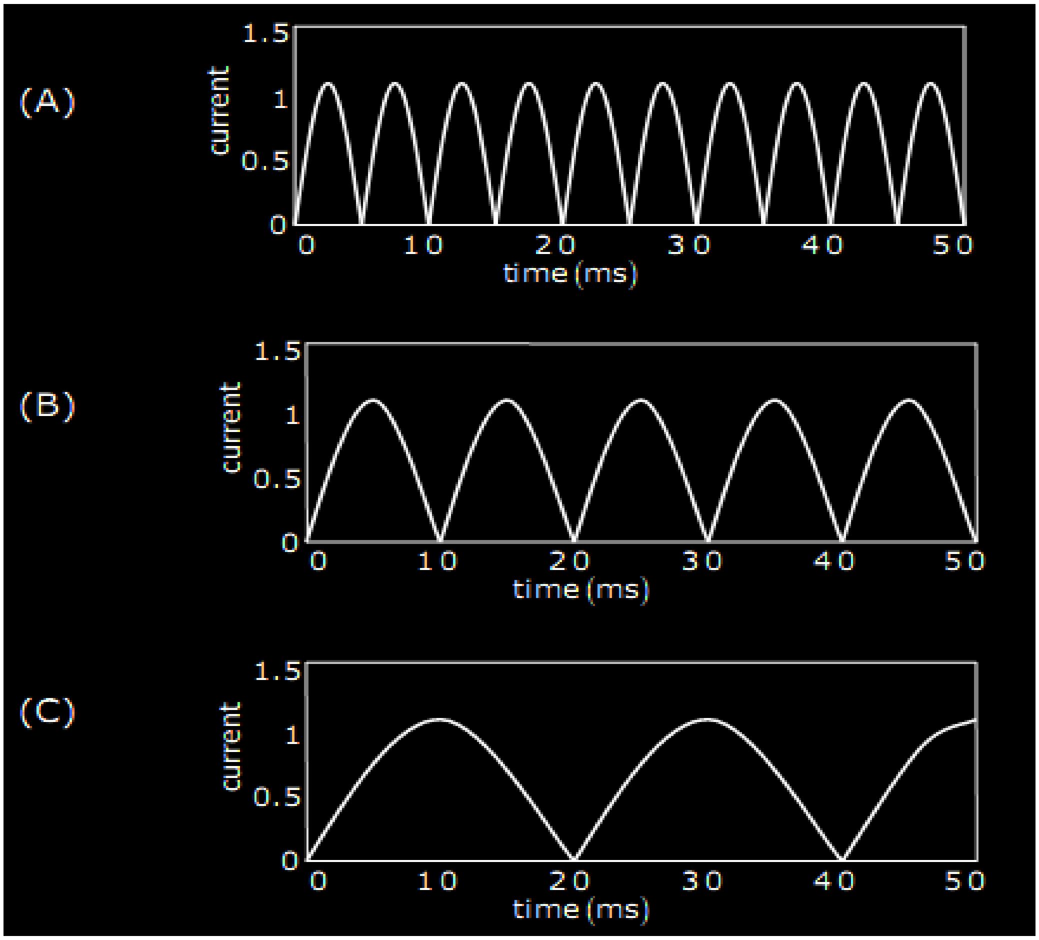
(B) rotates anticlockwise

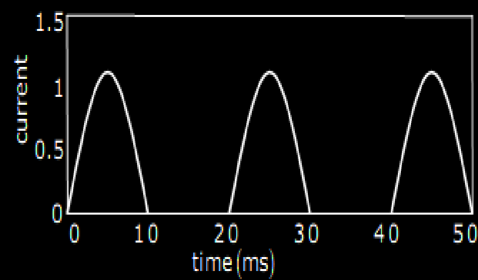
(C) does not rotate

(D) rotates momentarily and comes to a halt

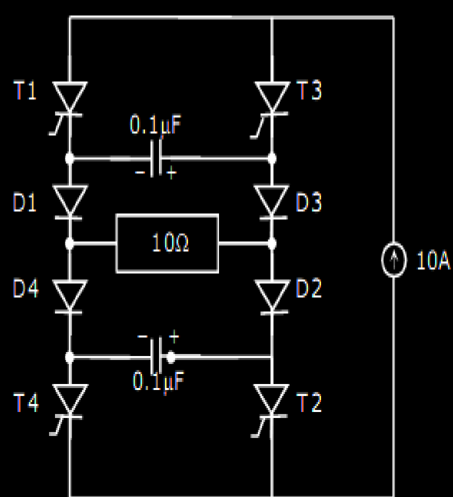
43. The circuit shows an ideal diode connected to a pure inductor and is connected to a purely sinusoidal 50Hz voltage source. Under ideal conditions the current waveform through the inductor will look like




(A)
current
1.5
1
0.5
0
0
10
20
30
40
50
time (ms)
(B)
current
1.5
1
0.5
0
0
10
20
30
40
50
time (ms)
(C)
current
1.5
1
0.5
0
0
10
20
30
40
50
time (ms)

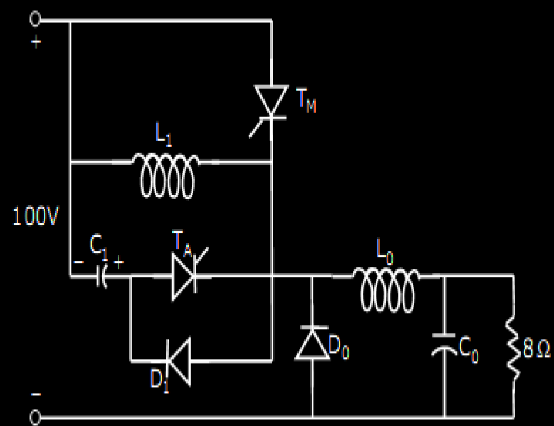
(D) 

44. The Current Source Inverter shown in figure, is operated by alternately turning on thyristor pairs (T_1, T_2) and (T_3, T_4). If the load is purely resistive, the theoretical maximum output frequency obtainable will be



(A) 125kHz (B) 250kHz (C) 500kHz (D) 50kHz

45. In the chopper circuit shown, the main thyristor (T_M) is operated at a duty ratio of 0.8, which is much larger the commutation interval. If the maximum allowable reapplied dv/dt on T_M is 50 V/μs, what should be the theoretical minimum value of C_1? Assume current ripple through L_o to be negligible.



(A) 0.2μF (B) 0.02μF (C) 2μF (D) 20μF