GATE WALLAH

18TH FEBRUARY 2024
EVENING SESSION

ESE

ENGINEERING | SERVICE | EXAMINATION

ELECTRICAL ENGINEERING

PAPER-2

Detailed Solution

by Team

PAPER-II

ELECTRICAL ENGINEERING

Time : 2 Hours **Maximum Marks : 300**

1. In Double Data Rate SDRAM, if 100 MHz clock rate and 64 bits data bus transfers data, then what is the approximate transfer rate for DDR3?

(a) 1600 MB/s (b) 6400 MB/s

(c) 3200 MB/s (d) 800 MB/s

2. What is the approximate rotational delay if the disk drive has 8 surfaces, each surface has 1024 tracks, each track has 64 sectors, each sector can hold 512 bytes and rotation speed of 6000 r.p.m.? (It is assumed that the sector is away from head half of the track)

(a) 0.005 s (b) 0.050 s

(c) 0.500 s (d) 0.505 s

3. How many pages are in the disk, if the capacity of a virtual disk is 2 MB and each page is 2 kB in a byte-addressable system?

(a) 2048 (b) 1024

(c) 100 (d) 500

4. Which one of the following is used to keep the track of program statistics that may be a valuable tool for system administrators who wish to reconfigure the system to improve computing services?

(a) Programming table

(b) Spooling

(c) Logging

(d) Making file

5. If communicating processes reside in a temporary queue and the queue has a maximum length of zero, then the link cannot have any messages waiting in it. The sender must block until the recipient receives the message. In what way can such queues be implemented?

(a) Bounded capacity

(b) Unbounded capacity

(c) Non-zero capacity

(d) Zero capacity

6. Consider the following set of processes that arrive at time 0 with the length of the CPU burst given in milliseconds :

Process	Burst time
P_1	24
P_2	3
P_3	3

What is the average waiting time under the Round-Robin Scheduling, if we use a time quantum of 4 milliseconds?

(a) 5366 milli seconds

(b) 3.50 milli seconds

(c) 7.00 milli seconds

(d) 6.55 milli seconds

7. Consider the following set of processes, assumed to have arrived at time 0 in the order P1, P2, …., P5, with the length of the CPU burst given in milliseconds :

Process	Burst time	Priority
P_1	10	3
P_2	1	1
P_3	2	4
P_4	1	5
P_5	5	2

Assuming that low numbers represent high priority, what is the average waiting time under the priority scheduling?

(a) 5.66 milli seconds

(b) 4.50 milli seconds

(c) 8.20 milli seconds

(d) 6.55 milli seconds

8. Which one of the following statements is correct regarding superheaters in steam power plants?

(a) In modem utility high-pressure boilers, more than 40% of the total heat absorbed in the generation of steam takes place in the superheaters.

(b) In modem utility high-pressure boilers, less than 40% of the total heat absorbed in the generation of steam takes place in the superheaters.

(c) In modem utility high-pressure boilers, less than 20% of the total heat absorbed in the generation of steam takes place in the superheaters.

(d) In modem utility high-pressure boilers, less than 30% of the total heat absorbed in the generation of steam takes place in the superheaters.

9. What are the advantages of bundle conductors?

(a) Reactance is reduced, GMR is increased and voltage gradient is reduced

(b) Surge impedance is reduced, GMR is decreased and voltage gradient is increased

(c) Reactance is increased, GMR is increased and voltage gradient is reduced

(d) Corona loss is reduced, GMR is increased and voltage gradient is increased

10. If the loading of the line is less than the surge impedance loading, then which one of the following statements is correct?

(a) The absorbed reactive power is greater than the generated reactive power and receiving-end voltage is greater than sending-end voltage.

(b) The absorbed reactive power is less than the generated reactive power and receiving-end voltage is greater than sending-end voltage.

(c) The absorbed reactive power is greater than the generated reactive power and receiving-end voltage is less than sending-end voltage.

(d) The absorbed reactive power is less than the generated reactive power and receiving-end voltage is less than sending-end voltage.

11. What are the overall diameter and dia of meta!) sheath of a single-core cable respectively for working voltage of 80 kV, the dielectric strength of the insulating material being 60 kV/cm?

(a) 266 cm and 2-66e cm

(b) 3-66 cm and 3-66 e cm

(c) 4-66 cm and 4-66e cm

(d) 3-66 cm and 2-66e cm

12. Which one of the following is correct regarding reduction of corona loss?

(a) Corona losses can be reduced by using large dia conductors, hollow conductors and bundled conductors

(b) Corona losses can be reduced by using small dia conductors, hollow conductors and bundled conductors

(c) Corona losses can be reduced by using large dia conductors, hollow conductors and single conductors

(d) Corona losses can be reduced by using large dia conductors, solid conductors and single conductors

13. Which one of the following types of relay is used to give directional feature to reactance relay?

(a) 1DMT relay

(b) Impedance relay Mho relay

(c) Mho relay

(d) Non-directional reactance relay

14. What are the values of breaking current and making current of a circuit breaker respectively, rated at 1000 A, 2000 $\sqrt{3}$ MVA, 20 kV, 3 s, oil circuit breaker?

(a) 100 kA and 255 kA

(b) 200 kA and 255 kA

(c) 100 kA and 200 kA

(d) 200 kA and 200 kA

15. The nodal admittance formulation, using the nodal voltages as the independent variables, is the most economic

(a) In the view of computer time only

(b) In the view of computer memory only

(c) Int eh view of both computer time and memory

(d) In the view of stability

ELECTRICAL ENGINEERING

16. The lap-connected armature winding is suitable for

(a) low-voltage and high-current generators
(b) low-voltage and low-current generators
(c) High-voltage and low-current generators
(d) High-voltage and high-current generators

17. Which one of the following statements is not correct regarding interpoles of DC machines?

(a) They are small yoke-fixed poles spaced in between the main poles.
(b) Their polarity, in the case of generators, is the same as that of the main pole ahead.
(c) They are connected in parallel with the armature so that they carry part of the armature current.
(d) They automatically neutralize not only reactance voltage but crossmagnetization as well.

18. A DC series motor, running a fan at 1000 r.p.m., takes 50 A from 250 V mains. The armature plus field resistance is 0.6 Ω. If an additional resistance of 4.4 Ω is inserted in series with the armature circuit, what is the value of the motor speed when the field flux is proportional to the armature current?

(a) 621 r.p.m. (b) 641 r.p.m.
(c) 651 r.p.m. (d) 661 r.p.m.

19. A three-phase, 60 Hz, 25 hp, wye-connected induction motor operates at a shaft speed of almost 1800 r.p.m. at no load and 1650 r.p.m. at full load. What are the values of speed of the rotor Geld with respect to the rotor itself and with respect to the stator Geld respectively?

(a) 150 r.p.m. and 1800 r.p.m.
(b) 1650 r.p.m. and 0 r.p.m.
(c) 150 r.p.m. and 0 r.p.m.
(d) 1800 r.p.m. and 150 r.p.m.

20. The rotor input of a three-phase induction motor running with a slip of 10% is 100 k\V. What is the value of the gross power developed by the rotor?

(a) 10 kW
(b) 80 kW
(c) 90 kW
(d) 95 kW

21. What is the value of percentage voltage regulation of an alternator having 0.75 leading power factor loads, when the no-load induced e.m.f. is 2400 V and the rated terminal voltage is 3000 V?

(a) 20% (b) –20%
(c) 25% (d) –25%

22. Two identical alternators arc running in parallel and carry equal loads. What will happen if the excitation of one alternator is increased without changing its steam supply?

(a) It will keep supplying almost the same load
(b) kVAR supplied by it would decrease
(c) kVA supplied by it would decrease
(d) Its power factor will increase

23. A synchronous motor connected to infinite bus-bar has, at constant full load, 100% excitation and unity power factor. When there is a change in excitation only, the armature current will have

(a) leading power factor with underexcitation
(b) lagging power factor with overexcitation
(c) leading power factor with overexcitation
(d) no change in power factor

24. What are the values of maximum step rate for permanent-magnet and variable-reluctance stepper motors respectively?

(a) 300 pulses per second and 1200 pulses per second
(b) 700 pulses per second and 1200 pulses per second
(c) 1200 pulses per second and 1200 pulses per second
(d) 300 pulses per second and 300 pulses per second

25. Consider the following statements regarding ideal transformer :

1. The winding resistances of the primary and secondary of the transformer are zero.
2. The eddy current loss of the transformer is zero.
3. The core of the transformer is having a finite permeability.

Which of the above statements is/are not correct?

(a) 1 and 3 (b) 2 only
(c) 3 only (d) 1 and 2

26. Consider the following characteristics of Complex Instruction Set Computer (CJSC) processor:

1. It is having a small number of instructions.
2. It is having less addressing modes.
3. Most instructions can manipulate operands in the memory.
4. Control unit is microprogrammed.

Which of the above characteristics is/are not correct?

(a) 1 only (b) 1 and 2
(c) 1 and 4 (d) 3 and 4

27. In which of the following processors, the designer can add easily new instruction without changing the architecture of the processor?

(a) CISC processor only
(b) RISC processor only
(c) Both CISC and RISC processors
(d) Neither CISC processor nor RISC processor

28. Which one of the following is used lo increase the performance of CPU, that means executing more instructions in less time?

(a) Sequencing (b) Pipelining
(c) Scheduling (d) Spooling

29. Which one of the following buses was designed to improve bandwidth and decrease latency in computer systems?

(a) PCI bus (b) VESA bus
(c) EISA bus (d) ISA bus

30. Consider the following functions of Root Hub :

1. It performs power distribution to the devices.
2. It enables and disables the ports.
3. It reports status of each port to the user.

Which of the above functions is/are correct?

(a) 1 only (b) 2 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

31. A 50 Hz, four-pole turbo-generator rated at 30 MVA, 13.2 kV has an inertia constant of H = 10 kW-s/kVA. What is the value of kinetic energy stored in the rotor at synchronous speed?

(a) 180 megajoules (b) 200 megajoules
(c) 300 megajoules (d) 400 megajoules

32. Which of the following is correct regarding the advantages of DC transmission over AC transmission?

(a) Power per conductor is more, more corona loss and possibility of higher operating voltages
(b) Power per conductor is more, less corona loss and possibility of higher operating voltages
(c) Power per conductor is more, no skin effect and possibility of lower operating voltages
(d) Power per conductor is more, there is charging current and possibility of higher operating voltages

33. Which one of the following statements is correct regarding shunt/series capacitor?

(a) Shunt capacitor improves the power factor whereas scries capacitor improves the stability of transmission line.
(b) Series capacitor improves the power factor whereas shunt capacitor improves the stability of transmission line.
(c) Shunt capacitor improves both the power factor and the stability of transmission line.
(d) Series capacitor improves both the power factor and the stability of transmission line.

34. In smart grid, the model load, FACTS devices and control, protection platform as compared to conventional grid are respectively

(a) dynamic, specified and adaptive nature
(b) dynamic, adaptive and adaptive nature
(c) dynamic, adaptive and defined nature
(d) static, adaptive and adaptive nature

35. A large hydropower station has a head of 324 m and an average flow of 1370 m^3/s. The reservoir of water behind the dams and dikes is composed of series of lakes covering an area of 6400 km^2. What is the available hydraulic power?

(a) 4350 kW (b) 4350 MW

(c) 435 MW (d) 435 kW

36. Consider the following statements regarding semiconductor diode :

1 In toe non-conducting region (when the p-n junction is reverse biased), the diode current is exactly zero.

2. The diode requires a small positive voltage to be applied before it enters the conducting region.

3. For large input voltages and/or currents, the diode enters breakdown regions in the forward direction.

Which of the above statements is/are correct?

(a) 1 and 2 (b) 2 only

(c) 1 only (d) 2 and 3

37. The mobilities of free electrons and holes in pure silicon are 1300 cm^2/V-s and 500 cm^2/V-s respectively. What is the value of intrinsic conductivity for silicon? (Assume $n_i = 1.5 \times 1010$ cm^{-3} for silicon at room temperature)

(a) 2.69×10^{13} S/cm

(b) 4.32×10^{-6} S/cm

(c) 4.32×10^{13} S/cm

(d) 2.69×10^{-6} S/cm

38. What happens to the depletion region and the depletion region capacitance of a p-n junction diode with increased reverse-biased voltage?

(a) The depletion region shrinks and the depletion region capacitance decreases

(b) The depletion region shrinks and the depletion region capacitance increases

(c) The depletion region widens and the depletion region capacitance decreases

(d) The depletion region widens and the depletion region capacitance increases

39. Consider the following statements regarding voltage-divider bias in a transistor :

1. The voltage-divider bias configuration uses two DC bias sources to provide forward-reverse bias to the transistor.

2. The voltage-divider bias provides a very small base current to the transistor compared to the bias current.

3. Two resistors and R_1 and R_2 a voltage divider that provides the base bias voltage to the transistor.

Which of the above statements is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 2 only

(d) 1, 2 and 3

40. In an n-type semiconductor, the Fermi level is 0.3 eV below the conduction level at a room temperature of 300 K. If the temperature is increased to 360 K, what is the new position of the Fermi level?

(a) Remains unchanged

(b) 0.26 eV above the conduction level

(c) 0.36 eV above the conduction level

(d) 0.36 eV below the conduction level

41. Consider the following statements regarding common-base transistor amplifier :

1. In the active region, the collector-base junction is forward biased while the base-emitter junction is reverse biased.

2. In the cutoff region, the collector-base and base-emitter junctions of a transistor are both reverse biased.

3. In the saturation region, the collector-base and base-emitter junctions are both forward biased.

Which of the above statements is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 2 only

(d) 1, 2 and 3

42. What are the biasing states of collector-base junction and base-emitter junction in the active region of a common-emitter transistor amplifier?

(a) Both collector-base junction and base-emitter junction are forward biased

(b) Both collector-base junction and base-emitter junction are reverse biased

(c) The collector-base junction is forward biased and the base-emitter junction is reverse biased

(d) The collector-base junction is reverse biased and the base-emitter junction is forward biased

43. Match the following lists :

List-I		List-II	
P.	Cutoff region	1.	$I_C = \beta_F I_B,\ I_B > 0,$ $V_{BE} > V_{BE(on)},\ V_{CE} > V_{CE(sat)}$
Q.	Saturation region	2.	$I_C = I_B = I_E = 0,$ $V_{BE} < V_{BE(on)},\ V_{BC} < V_{BC(on)}$
R.	Forward active region	3.	$I_B > 0,\ I_C > 0,\ I_C < \beta_F I_B,$ $V_{BE} > V_{BE(on)}$

Select the correct answer using the code given below.

(a) $P \rightarrow 1,\ Q \rightarrow 2,\ R \rightarrow 3$

(b) $P \rightarrow 2,\ Q \rightarrow 3,\ R \rightarrow 1$

(c) $P \rightarrow 1,\ Q \rightarrow 3,\ R \rightarrow 2$

(d) $P \rightarrow 2,\ Q \rightarrow 1,\ R \rightarrow 3$

44. Consider the following statements regarding negative feedback in amplifier circuits :

1. It has reduction in overall voltage gain.
2. It has enhanced frequency response.
3. It has higher output impedance.

Which of the above statements is/are correct?

(a) 1 and 2 only (b) 2 and 3 only

(c) 2 only (d) 1, 2 and 3

45. In the Hartley oscillator, L_2 = 0.4 mH and C = 0.004 μF. If the frequency of the oscillator is 120 kHz, what is the value of L_1? (Neglect the mutual inductance)

(a) 4 mH (b) 0.04 mH

(c) 0.4 mH (d) 40 mH

46. A set of independent current measurements is recorded as 10.03A, 10.10A, 10.11A and 10.08 A. What are the values of average current and range of error respectively?

(a) 10.08A and ± 0.03A

(b) 10.08A and ± 0.04A

(c) 10.09A and ± 0.04A

(d) 10.09A and ± 0.03A

47. During the measurement of low resistance using a potentiometer, the following readings were obtained :

The voltage drop across the low resistance under test = 0.4221 V

The voltage drop across a 0.1 Ω standard resistance = 1.0235 V

What are the values of unknown resistance and current respectively?

(a) 0.041208 Ω and ± 10.235 A

(b) 0.031208 Ω and ± 10.235 A

(c) 0.021208 Ω and ± 10.235 A

(d) 0.041208 Ω and ± 11.235 A

48. The coil of a moving-coil voltmeter is 40 mm long and 30 mm wide and has 100 turns on it. The control spring exerts a torque of 240×10^{-6} N-m when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is 1.0 Wb/m^2, what is the value of the resistance that must be put in series with the coil to give one volt per division by neglecting the resistance of the voltmeter coil?

(a) 5 kΩ (b) 15 kΩ

(c) 50 kΩ (d) 75 kΩ

49. Which one of the following statements is correct regarding moving-iron instrument when voltages or currents are measured?

(a) It indicates the same value of the measurement for both ascending and descending values.

(b) It indicates the higher value of the measurement for ascending values.

(c) It indicates the higher value of the measurement for descending values.

(d) It indicates the lower value of the measurement for descending values.

50. A moving-coil instrument gives a full-scale deflection of 10 mA, when the potential difference across its terminals is 100 mV. What is the value of shunt resistance for a full-scale deflection corresponding to 100 A?

(a) 0.0001 Ω (b) 0.001 Ω
(c) 0.01 Ω (d) 0.1 Ω

51. The power in a three-phase circuit is measured with the help of 2 wattmeters. The reading of one of the wattmeters is positive and that of the other is negative. The magnitudes of readings arc different. What is the value of the power factor of the circuit under this condition?

(a) 0.5 (lagging)
(b) Zero (lagging)
(c) Less than 0.5 (lagging)
(d) Unity

52. What is the range of frequency measured by the typical frequency meter?

(a) 1 MHz (b) 10 MHz
(c) 1 kHz (d) 1 GHz

53. A $3\frac{1}{2}$ digit DVM has an accuracy specification of ± 0.5 percent of reading ± 1 digit. What is the possible error in volt, when the instrument is reading 5.00 V on the 10 V range?

(a) 0.015 V (b) 0.025 V
(c) 0.035 V (d) 0.045 V

54. Which one of the following statements is correct regarding potentiometric recorders?

(a) A sensitivity of 4 VB/mm is attained with an error of less than ± 0.25% with a bandwidth of 0.8 Hz.
(b) A sensitivity of 10 VB/mm is attained with an error of less than ± 0-35% with a bandwidth of 0.9 Hz.
(c) A sensitivity of 5 VB/mm is attained with an error of less than ± 0.25% with a bandwidth of 1 Hz.
(d) A sensitivity of 8 VB/mm is attained with an error of less than ± 0.45% with a bandwidth of 0.8 Hz.

55. If the bandwidth of an oscilloscope is given as direct current to 10 MHz, what is the fastest rise time a sine wave can have to be accurately reproduced by the instrument?

(a) 35 ns (b) 17.5 ns
(c) 0.175 μs (d) 35 μs

56. What is the key factor that must be considered while selecting a transducer for a particular application?

(a) Only the input characteristics should be considered
(b) Only the output characteristics should be considered
(c) Only the transfer characteristics should be considered
(d) Input, output and transfer characteristics should be considered

57. If a transducer has an output impedance of 1 Ω and a load resistance of 1 kΩ, it behaves as

(a) a constant current source
(b) a constant voltage source
(c) a constant power source
(d) a constant energy source

58. If a 50 Hz, 220/400 V, 50 kVA, single-phase transformer operates on 220 V, 40 Hz supply with secondary winding, then what about the core losses of the transformer?

(a) The hysteresis losses and the eddy current losses of the transformer increase
(b) The hysteresis losses and the eddy current losses of the transformer decrease
(c) The hysteresis losses remain same whereas the eddy current losses decrease
(d) The hysteresis losses increase whereas the eddy current losses remain same

59. An 1100/415 V, delta-star transformer feeds power to a 30 kW, 415 V, three-phase induction motor having an efficiency of 90% and full-load p.f. 0.833. What are the rating of the transformer and line current of low-voltage side respectively?

(a) 35 kVA, 55.65 A
(b) 40 kVA, 55.65 A
(c) 40 kVA, 45.65 A
(d) 45 kVA, 55.65 A

60. The kVA rating of an ordinary two-winding transformer increases when connected as an autotransformer because
(a) transformation ratio increases
(b) secondary current increases
(c) energy is transferred both inductively and conductively
(d) secondary voltage increases

61. In a Wien bridge oscillator, if the value of R is 10 kΩ and the frequency of oscillation is 10 kHz, what is the value of capacitor C?
(a) 0.159 pF (b) 15.9 pF
(c) 159 pF (d) 1.59 pF

62. Consider the following statements regarding frequency stability oscillator:
1. Due to change in temperature, the values of the frequency-determining components, viz., resistor, inductor and capacitor are changed.
2. Frequency can affect due to variation in biasing conditions and loading conditions.
3. The effective resistance of the tank circuit is unchanged when the load is connected.

Which of the above statements is/are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 2 only (d) 1, 2 and 3

63. A power diode can be used as a switch because its resistance can be controlled with
(a) applied current (b) small current
(c) higher current (d) applied voltage

64. The reverse current reduces and the voltage across the power diode grows more negative during the turnoff process of the power diode. This time is called
(a) fall time
(b) recovery time
(c) reverse recovery time
(d) rise time

65. What are the significant advantages of MOS power transistor over bipolar power transistor in the pulse power supplies?
(a) Very high input resistance and the input currents are of the order of nA
(b) Very low input resistance and the input currents are of the order of kA
(c) Very high input resistance and the input currents are of the order of kA
(d) Very low input resistance and the input currents are of the order of nA

66. In a gate turnoff thyristor, the turning-off is achieved by
(a) latching current at gate
(b) holding current at gate
(c) positive current at gate
(d) negative current at gate

67. The function of a capacitive filter in a Graetz diode bridge rectifier is to
(a) remove small load current ripples from the rectified output signal
(b) minimize voltage variations in AC input signal
(c) reduce harmonics in the rectified output signal
(d) introduce more ripples into the rectified output signal

68. The use of an inductive filter in a rectifier circuit provides satisfactory performance only when
(a) the load current is high
(b) the load voltage is high
(c) the load current is low
(d) the load voltage is low

69. If a separately excited DC motor is to be operated in the first quadrant only, the converter is used in
(a) single-phase half-controlled rectifier
(b) single-phase full-controlled rectifier
(c) single-phase dual-controlled rectifier
(d) four-quadrant chopper

70. The static Scherbius drive can able to provide
(a) variable torque control
(b) constant torque control
(c) braking operation
(d) variable speed

71. Which one of the following statements is correct regarding series resonant inverter?
(a) The load current is a square waveform.
(b) The output voltage waveform depends on the damping factor of load impedance.
(c) The trigger frequency is higher than the damped resonant frequency.
(d) The input voltage waveform depends on the damping factor of load impedance.

72. If a single-phase full-bridge voltage source inverter operates with *R* load, the nature of output current is

(a) square wave (b) sine wave

(c) triangular wave (d) pulse wave

73. Which one of the following cores is used for large mains transformers to reduce eddy current loss of high-frequency operation in power electronic circuit?

(a) Laminated iron core

(b) Laminated steel core

(c) Compressed ferromagnetic alloy core

(d) Ferromagnetic alloy core

74. When an induction motor and a heater are supplied from a phase-controlled single-phase AC voltage controllers, then

(a) only fundamental component of output voltage and current is useful in the induction motor but fundamental and harmonics are useful in the heater

(b) fundamental and harmonics are useful in the induction motor but only fundamental component of output voltage and current is useful in the heater

(c) both fundamental and harmonics are useful in the induction motor and heater

(d) only harmonics are useful in the induction motor and heater

75. Consider the following statements regarding IGBT :

1. It combines into it the advantages of both MOSFET and BJT.

2. It is free from second breakdown problem present in BJT.

3. It has low input impedance and high power loss.

Which of the above statements is/are correct?

(a) 1 only (b) 2 and 3 only

(c) 1 and 2 only (d) 1, 2 and 3

76. What is the value of $\int_0^{2+i} (\overline{z})^2 \, dz$, along the line $y = x/2$?

(a) $\frac{5}{3}(2-i)$ (b) $\frac{1}{3}(2-i)$

(c) $\frac{4}{3}(2+i)$ (d) $2-i$

77. The following is the frequency distribution of a random sample of weekly earnings of 509 employees :

Weekly earning	No. of employees
10	3
12	6
14	10
16	15
18	24
20	42
22	75
24	90
26	79
26	79
28	55
30	36
32	26
34	19
36	13
38	9
40	7

What is the average weekly earning?

(a) 26 · 16 (b) 28 · 61

(c) 24 · 87 (d) 20 · 74

78. The numbers examined, the mean weight and the standard deviation in each group of examination by three medical examiners are given below. What is the standard deviation of the entire data when grouped together?

Med. Exam	Nos. examined	Mean *wt.* (1b)	SD (1b)
A	50	113	6
B	60	120	7
C	90	115	8

(a) 8·183 1b (b) 7·746 1b

(c) 7·152 1b (d) 6·981 1b

ELECTRICAL ENGINEERING

79. The solution for $\frac{d^4x}{dt^4} + 4x = 0$ is

(a) $x = e^{-t}(c_1 \cos 2t + c_2 \sin 2t) + e^{t}(c_3 \cos 2t + c_4 \sin 2t)$
(b) $x = e^{-t}(c_1 \cos 4t + c_2 \sin 4t) + e^{t}(c_3 \cos 4t + c_4 \sin 4t)$
(c) $x = e^{-t}(c_1 \cos t + c_2 \sin t) + e^{t}(c_3 \cos t + c_4 \sin t)$
(d) $x = e^{-2t}(c_1 \cos t + c_2 \sin t) + e^{4t}(c_3 \cos t + c_4 \sin t)$

80. What is the deflection $u(x, y, t]$ of the square membrane with $a = b$ and $c = 1$, if the initial velocity is zero and the initial deflection is $f(x, y) = A \sin\pi x \sin 2\pi y$?

(a) $A \sin\pi x \sin 2\pi y$
(b) $A \sin\pi x \sin 2\pi y \sin(\sqrt{3}\, \pi t)$
(c) $A \sin\pi x \sin 2\pi y \tan(\sqrt{6}\, \pi t)$
(d) $A \sin\pi x \sin 2\pi y \cos(\sqrt{5}\, \pi t)$

81. If $u = x \log xy$, where $x^3 + y^3 + 3xy = 1$, what is du/dx ?

(a) $du/dx = \log xy - x(x^2 + y)/y(y^2 + x)$
(b) $du/dx = 0{\cdot}5 + \log xy - x(x^2 + 2y)/y(y^2 + x)$
(c) $du/dx = 2 + \log xy - x(x^2 + y)/y(y^2 + 2x)$
(d) $du/dx = 1 + \log xy - x(x^2 + y)/y(y^2 + x)$

82. What is the particular integral of

$(D^3 + 1)y = \cos(2x - 1)$?

(a) $\frac{1}{25}[\cos(2x-1) - 5\sin(2x-1)]$
(b) $\frac{1}{55}[\cos(2x-1) - 6\cos(2x-1)]$
(c) $\frac{1}{65}[\cos(2x-1) - 8\sin(2x-1)]$
(d) $\frac{1}{75}[\sin(2x-1) - 4\sin(2x-1)]$

83. Let X be a Poisson variate such that

$P[X = 2] = 9P[X = 4] + 90P[X = 6]$

Then $E[X]$ is equal to

(a) 1 (b) e^2
(c) log 2 (d) $\frac{1}{2}$

84. A random variable X takes values 0, 1, 2, 3, ……. with probability proportional to $(x+1)\left(\frac{1}{5}\right)^x$ Then $p[X \le 2]$ is

(a) $\frac{1}{225}$ (b) $\frac{503}{911}$
(c) $\frac{603}{625}$ (d) $\frac{608}{625}$

85. A die is thrown as long as necessary for a 6 to tum up. Given that 6 does not turn up at the first throw. What is the probability that more than four throws arc necessary?

(a) $\frac{125}{216}$ (b) $\frac{121}{323}$
(c) $\frac{271}{341}$ (d) $\frac{9}{19}$

86. If A and B are independent events and $P[A] = P[B|X]$ = then $P[A \cup B]$ is

(a) $\frac{2}{5}$ (b) $\frac{3}{7}$
(c) $\frac{5}{9}$ (d) $\frac{3}{4}$

87. The solution of the initial value problem

$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0;\ y(0) = 6,\ y'(0) = 2$

(a) $2e^x + 3e^{7x}$
(b) $e^x - e^{7x}$
(c) $4e^{2x} + 2e^{-3x}$
(d) $e^x(\sin x + \cos x)$

88. How is J-K flip-flop created from S-R latch?

(a) By adding more inputs
(b) By replacing the S and R inputs with NAND gates
(c) By connecting the inputs to the outputs
(d) By changing the clock input

89. How many select input lines are there in 1-to-8 demultiplexer?

(a) 2 (b) 1
(c) 4 (d) 3

ELECTRICAL ENGINEERING

90. How many comparators and resistors are used in n-bit flash A-to-D converter respectively?

(a) 2^n and $2^n - 1$ (b) 2^n and $2^n + 1$
(c) $2^n + 1$ and 2^n (d) $2^n - 1$ and 2^n

91. What arc the important characteristics that must be satisfied for the materials used to build permanent magnets?

(a) Low permeability, high coercive force and high Curie temperature
(b) Low permeability, high coercive force and low Curie temperature
(c) High permeability, high coercive force and high Curie temperature
(d) High permeability, low coercive force and low Curie temperature

92. What are the important characteristics that must be satisfied for the materials used to build core of the transformer?

(a) High permeability, low hysteresis and high eddy current losses
(b) High permeability, low hysteresis and eddy current losses
(c) High permeability, high hysteresis and eddy current losses
(d) Low permeability, low coercive force and low Curie temperature

93. What are the nominal values of drop in potential across conducting silicon diodes, Schottky diodes and light-emitting diodes respectively?

(a) 0·6 to 0·7 volt, 0·2 V and 1·4 V
(b) 0·6 to 0·7 volt, 1·2 V and 0·2 V
(c) 0·6 to 0·7 volt, 2·2 V and 1·4 V
(d) 0·6 to 0·7 volt, 0·2 V and 5·4 V

94. Which one of the following statements is correct related to extrinsic and degenerate semiconductors?

(a) Lightly and moderately doped semiconductor is referred to as extrinsic and when it is doped to such high levels that it acts more like a conductor than a semiconductor, it is referred to as degenerate.
(b) Heavily doped semiconductor is referred to as extrinsic and when it is doped to such high levels that it acts more like a conductor than a semiconductor, it is referred to as degenerate.
(c) Moderately doped semiconductor is referred to as extrinsic and when it is doped to such low levels that it acts more like a conductor than a semiconductor, it is referred to as degenerate.
(d) Lightly doped semiconductor is referred to as extrinsic and when it is doped to such low levels that it acts more like a conductor than a semiconductor, it is referred to as degenerate.

95. What is an optoisolator?

(a) LED is paired with a photodiode or phototransistor in the same package and it allows *DC* coupling
(b) LED is paired with a silicon diode in the same package and it allows *AC* coupling
(c) LED is paired with a photodiode or phototransistor in the same package and it does not allow *DC* coupling
(d) LED is paired with a photodiode or phototransistor in the same package and it does not allow *AC* coupling

96. Which one of the following is correct related to Type-1 superconductors along with the critical transition temperature (T_c)?

(a) Lead (*Pb*) of 4·15 K, Mercury (*Hg*) of 7·196 K and Aluminium (*Al*) of 1·175 K
(b) Lead (*Pb*) of 7·196 K, Mercury (*Hg*) of 4·15 K and Aluminium (*Al*) of 1·175 K
(c) Lead (*Pb*) of 1·175 K, Mercury (*Hg*) of 4·15 K and Aluminium (*Al*) of 7·196 K
(d) Lead (*Pb*) of 7·196 K, Mercury (*Hg*) of 1·175 K and Aluminium (*Al*) of 4·15 K

97. Organic superconductors are composed of

(a) both an electron donor (the planar organic molecule) and an electron acceptor (a non-organic anion)
(b) an electron donor (the planar organic molecule) only
(c) an electron acceptor (a non-organic anion) only

(d) both an electron donor (a non-organic anion) and an electron acceptor (the planar organic molecule)

98. If the input signal is $x(n) = \sin c\left(\frac{\omega_c n}{\pi}\right)$, then what is the energy of the signal? (Assume $(\omega_c < \pi)$

(a) $\frac{\omega_c}{\pi}$ (b) $\frac{\pi}{\omega_c}$

(c) $\frac{\omega_c}{2\pi}$ (d) $\frac{2\pi}{\omega_c}$

99. Let $X(e^{j\omega})$ be the Fourier transform of the signal $x(n) = \{-1, 0, 1, \underset{\uparrow}{2}, 1, 0, 1, 2, 0, -1\}$, Where $-3 \le n \le 7$. what is the value of the following?

$$\int_{-\pi}^{\pi} \left|\frac{dX(e^{j\omega})}{d\omega}\right|^2 d\omega$$

(a) 28π (b) 256π

(c) 316π (d) 356π

100. What is the inverse Fourier transform of the following?

$$x(e^{j\omega}) = \begin{cases} 2j, & 0 < \omega \le \pi \\ -2j, & -\pi < \omega \le 0 \end{cases}$$

(a) $1 + \cos\left(\frac{\pi}{2} n\right)$

(b) $\frac{2}{n\pi} + \sin\left(\frac{n\pi}{2}\right)$

(c) $\frac{4}{n\pi} + \sin\left(\frac{n\pi}{4}\right)$

(d) $\frac{4}{n\pi} + \sin^2\left(\frac{n\pi}{2}\right)$

101. If $x(n) = \delta(n - 1) + \delta(n + 1)$, what is the DTFT value for the given signal?

(a) sin (ω) (b) cos (ω)

(c) 2 sin (ω) (d) 2 cos (ω)

102. If $x(n) = \cos(\omega_0 n)\, u(n)$, then what is the DTFT of the signal?

(a) $\pi[\delta(\omega - \omega_0) + \delta(\omega + \omega_0)]$

(b) $\pi[\delta(\omega - \omega_0) - \delta(\omega + \omega_0)]$

(c) $\pi + \pi^2[\delta(\omega - \omega_0) + \delta(\omega + \omega_0)]$

(d) $\pi^2 + \pi[\delta(\omega - \omega_0) + \delta(\omega + \omega_0)]$

103. What are the initial and final values of $y(t)$ respectively, if its Laplace transform is $Y(s) = \frac{10(2s+3)}{s(s^2+2s+5)}$

(a) 4 and 1 (b) 1 and 6

(c) 3 and 5 (d) 0 and 6

104. If the function $x(t) = 10 \sin c\left(\frac{t+4}{7}\right)$, then what is the total area under the function?

(a) 28 (b) 40

(c) 70 (d) $\frac{40}{7}$

105. If $x(t) = \delta(3t) + u(3t)$, then what are the Laplace transform and the associated ROC for the function of time respectively?

(a) $\frac{1}{3}\left(\frac{s^2+1}{s}\right), R(s) > 3$

(b) $\frac{1}{3}s + \frac{3}{s}, R(s) < 3$

(c) $\frac{s^2+3}{3s}, R(s) < 0$

(d) $\frac{s+3}{3s}, R(s) > 0$

106. What is the percentage resolution of a 4-bit *R*-2*R* ladder DAC, which has a reference voltage of 4.5 V?

(a) 6.25% (b) 6.67%

(c) 7.25% (d) 7.67%

107. Consider the following statements regarding successive approximation ADC :

1. The output data can be taken out of the converter either in series or in parallel.
2. The circuit is less complex compared to ramp ADC.
3. As the conversion time is not dependent on the analog input, so it is comparatively faster.

Which of the above statements is/are correct?

(a) 1 and 2 (b) 2 only

(c) 3 only (d) 1 and 3

108. What are the key properties of an op-amp which plays an important role in designing op-amp operated active filters?

(a) High output impedance, low input impedance and the possibility of having signal amplification to the desired level

(b) High input impedance, low output impedance and the possibility of having signal amplification to the desired level

(c) High output impedance, low input impedance and the possibility of having signal amplification to the higher level only

(d) High input impedance, low output impedance and the possibility of having signal amplification to the lower level only

109. Which one of the following stores all data written to and read from memory?

(a) Instruction register

(b) Memory buffer register

(c) Memory address register

(d) Status register

110. What does 'STA address' stand for in 8085 microprocessor?

(a) Copy the data byte at the memory location specified by the 16-bit address into the accumulator

(b) Copy the data from the source to the destination location specified by the 16-bit address

(c) Copy the data from the destination to the source location specified by the 16-bit address

(d) Copy the data from the accumulator to the memory location specified by the 16-bit address

111. An AM commercial broadcast receiver is operating in a frequency band of 535 kHz to 1605 kHz with an input filter factor of 54. What are the bandwidths at the low and high ends of RF spectrum respectively?

(a) 100 kHz and 29.63 kHz

(b) 10 kHz and 2.96 kHz

(c) 10 kHz and 29.63 kHz

(d) 100 kHz and 2.96 kHz

112. Consider the following statements regarding digital communication:

1. Digital signals can be coded to yield extremely low error rates and low fidelity.
2. Digital signals are easier to encrypt for security and privacy.
3. Digital signal storage is expensive.

Which of the above statements is/are correct?

(a) 1 and 2 (b) 2 only

(c) 3 only (d) 1 and 3

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

1. TDM is readily implemented with high-density VLSI circuitry.
2. TDM synchronization is less demanding than that of suppressed carrier FDM.
3. TDM crosstalk immunity does not depend on the transmission bandwidth.

Which of the above statements is/are correct?

(a) 1 and 2 (b) 2 only

(c) 1 only (d) 1 and 3

114. What is net baseband bandwidth in Frequency-Division Multiplexing?

(a) It is the sum of the modulated message bandwidths and the guard bands

(b) It is the product of the modulated message bandwidths and the guard bands

(c) It is the value obtained by subtracting modulated message bandwidths from the guard bands

(d) It is the product of the modulating message bandwidths and the modulated message

115. During serial transmission, a group of 512 sequential 12-bit data words is transmitted in 0.016 s. What is the speed of transmission?

(a) 384 kbps (b) 384 bps

(c) 6.84 kbps (d) 6.84 bps

116. What is the property of an isotropic material that must be satisfied?

(a) It has the same electric properties for the various directions of appliance of the electric field

(b) It has the different electric properties for the various directions of appliance of the electric field

(c) It has the different electric properties for the same direction of appliance of the electric field

(d) It has the same electric properties for the opposite directions of appliance of the electric field

117. What is the order of resistivity of conductive material?

(a) 10^{-6} Ω-m to 10^{-8} Ω-m

(b) 10^{6} Ω-m to 10^{8} Ω-m

(c) 10^{-10} Ω-m to 10^{8} Ω-m

(d) 10^{-9} Ω-m to 10^{12} Ω-m

118. What are the properties of good insulating material?

(a) Low dielectric strength, volume resistivity of high value and very low dissipation factor

(b) Low dielectric strength, volume resistivity of low value and very low dissipation factor

(c) Low dielectric strength, volume resistivity of low value and high dissipation factor

(d) High dielectric strength, volume resistivity of high value and very low dissipation factor

119. What is the value of the Curie temperature of iron?

(a) About 1043 K (b) About 1555 K

(c) About 1422 K (d) About 1322 K

120. Which one of the following is the correct relationship among the Curie temperatures of Fe, Ni and Co?

(a) (D/d) (Ni) Curie < (D/d) (Fe) Curie < (D/d) (Co) Curie

(b) (D/d) (Ni) Curie < (D/d) (Co) Curie < (D/d) (Fe) Curie

(c) (D/d) (Co) Curie < (D/d) (Ni) Curie < (D/d) (Fe) Curie

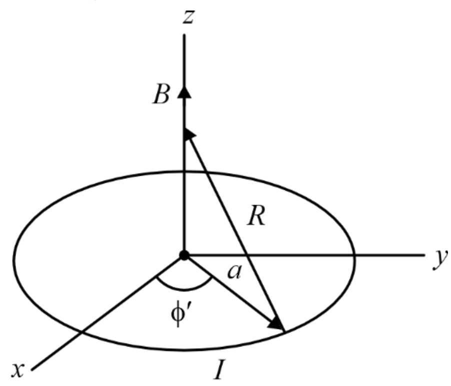
(d) (D/d) (Fe) Curie < (D/d) (Ni) Curie < (D/d) (Co) Curie

121. Two perfectly coupled coils each of 1 H self-inductance are connected in parallel so as to aid each other. What is the value of overall inductance?

(a) 0 H (b) 0.5 H

(c) 1 H (d) 2 H

122. What is the value of magnetic field on the axis that is perpendicular to the plane containing a circular loop of current shown in the figure using the Biot-Savart law?



(a) $B(z)=\left[\frac{\mu_0 m}{2\pi R^3}\right]$ (b) $B(z)=\left[\frac{\mu_0 m}{2\pi R^2}\right]$

(c) $B(z)=\left[\frac{\mu_0 m}{2\pi R^4}\right]$ (d) $B(z)=\left[\frac{\mu_0 m}{2\pi R}\right]$

123. What is the transfer function, $G(s) = C(s)/R(s)$, corresponding the following differential equation?

$$\frac{d^3c}{dt^3}+4\frac{d^2c}{dt^2}+6\frac{dc}{dt}+3c=\frac{d^2r}{dt^2}+6\frac{dr}{dt}+4r$$

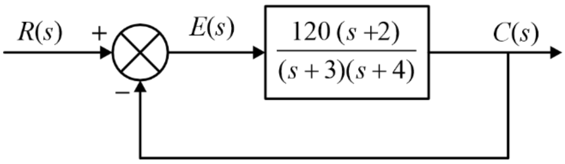
(a) $G(s)=\frac{s^2+6s+4}{s^3+4s^2+6s+3}$

(b) $G(s)=\frac{s^2+5s+4}{s^3+4s^2+6s+3}$

(c) $G(s)=\frac{s^2+6s+4}{s^3+5s^2+6s+3}$

(d) $G(s)=\frac{s^2+6s+4}{s^3+4s^2+5s+3}$

124. What are the steady-state errors for the inputs of $3u(t)$, $3tu(t)$ and $3t^2u(t)$ respectively to the system shown in the figure, where the function u(t) is the unit step?

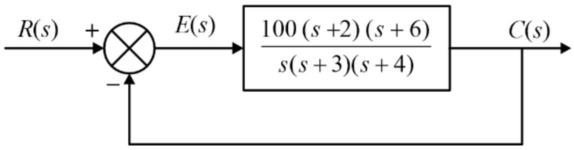


(a) $\frac{3}{21}$, ∞ and ∞ (b) $\frac{1}{6}$, ∞ and $\frac{1}{6}$

(c) ∞, ∞ and $\frac{1}{6}$ (d) $\frac{1}{6}$, ∞ and $\frac{3}{21}$

ELECTRICAL ENGINEERING

125. What arc the steady-state errors for the inputs of $4u(t)$, $4tu(t)$ and $4t^2u(t)$ respectively to the system shown in the figure, where the function $u(t)$ is the unit step?



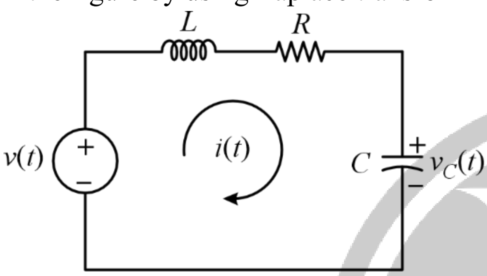
(a) $0, \infty$ and ∞

(b) $0, \frac{1}{25}$ and ∞

(c) ∞, ∞ and $\frac{1}{25}$

(d) $\frac{1}{25}, \infty$ and 0

126. The transfer function of the given circuit shown in the figure by using Laplace transform is



(a) $T(s) = \dfrac{\frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$

(b) $T(s) = \dfrac{\frac{1}{LC}}{s^2 + Rs + \frac{1}{LC}}$

(c) $T(s) = \dfrac{\frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{L}}$

(d) $T(s) = \dfrac{\frac{1}{LC}}{s^2 + \frac{1}{L}s + \frac{1}{LC}}$

127. What is the status of the closed-loop transfer function,

$$T(s) = \frac{10}{s^5 + 2s^4 + 4s^3 + 6s^2 + 2s + 5}$$

using Routh-Hurwitz criterion?

(a) Unstable

(b) Marginally stable

(c) Stable

(d) Neither stable nor unstable

128. What is/are the value (s) of K for which the system is stable for the characteristics equation $s^2 - (K + 2)s + (2K + 1) = 0$?

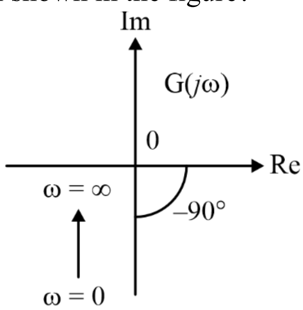
(a) $-(K + 2) > 0$ and $(2K + 5) > 0$

(b) $K = -2$ and $K = -2.5$

(c) $K < -2$ or $K < -2.5$

(d) $-(K + 2) < 0$ and $(2K + 5) > 0$

129. Which one of the following is the correct transfer function obtained from the Nyquist diagram shown in the figure?



(a) $G(s) = 1/s$

(b) $G(s) = K$

(c) $G(s) = 1/s^2$

(d) $G(s) = s$

130. Which one of the following statements is correct regarding root locus technique?

(a) It can be used to analyze and design the effect of loop gain upon the system's transient response and stability.

(b) It cannot be used to analyze and design the effect of loop gain upon the system's transient response and stability.

(c) It can be used to analyze and design the effect of loop gain upon the system's transient response only.

(d) It can be used to analyze and design the effect of loop gain upon the system's stability only.

131. The transfer function of a single, passive lag-lead network is

(a) $G_C(s) = \left[\left(s + \frac{1}{T_1}\right)\Big/\left(s + \frac{\gamma}{T_1}\right)\right]\left[\left(s + \frac{1}{T_2}\right)\Big/\left(s + \frac{1}{\gamma T_2}\right)\right]$

(b) $G_C(s) = \left[\left(s + \frac{1}{T_1}\right)\Big/\left(s + \frac{\gamma}{T_1}\right)\right]\left[\left(s + \frac{1}{T_2}\right)\Big/\left(s + \frac{\gamma}{T_2}\right)\right]$

(c) $G_C(s) = \left[\left(s + \frac{1}{T_1}\right)\Big/\left(s + \frac{1}{\gamma T_1}\right)\right]\left[\left(s + \frac{1}{T_2}\right)\Big/\left(s + \frac{\gamma}{T_2}\right)\right]$

(d) $G_C(s) = \left[\left(s + \frac{1}{T_1}\right)\Big/\left(s + \frac{\gamma}{T_1}\right)\right]\left[\left(s + \frac{\gamma}{T_2}\right)\Big/\left(s + \frac{1}{T_2}\right)\right]$

132. Which one of the following statements is correct regarding state variable approach over transfer function approach?

(a) The state variable can be fed back, it considers the initial conditions and state model of a system is unique.

(b) The state variable can be fed back, it considers the initial conditions and state model of a system is not unique.

(c) The state variable cannot be fed back, it considers the initial conditions and state model of a system is unique.

(d) The state variable can be fed back, it neglects the initial conditions and state model of a system is not unique.

133. What is the controllability of the state equation for the given system?

$$\dot{x} = Ax + Bu = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u$$

(a) The system is controllable

(b) The system is not controllable

(c) It is not possible to find the controllability

(d) It is neither controllable nor stable

134. If the initial-state vector, $x(t_0)$, can be found from $u(t)$ and $y(t)$ measured over a finite interval of time from t_0, then the system is

(a) unobservable

(b) observable

(c) not possible to find the observability

(d) neither unobservable nor observable

135. The open-loop transfer function of a unity feedback system is $G(s) = \dfrac{20}{0.21s+1}$. What is the time response subjected to a step input $X(s)$ = 0.8/s?

(a) $0.76(1 - e^{-t/100})$

(b) $0.76\ (1 - e^{-t/0.01})$

(c) $0.95\ (1 - e^{-t/100})$

(d) $0.95\ (1 - e^{-t/0.01})$

136. Consider a random variable X with a uniform p.d.f. on $\left[-\dfrac{1}{2}, \dfrac{1}{2}\right]$. Assume that the random variable $Y = X^2$, i.e., $g(r) = r^2$. What is the value of $E(Y)$?

(a) 1/4 (b) 1/12

(c) 1/16 (d) 1/256

137. What is the relationship between H(1) and H(2) from, the N-point DFT of

$h(n) = e^{-\frac{n}{5}},\ 0 \le n \le N$? (Take N = 3)

(a) H(1) = H(2) (b) H(1) = H*(2)

(c) H(2) = 2H(1) (d) H(2) = H(1) = 0

138. What is the autocorrelation of the energy signal $x(t) = e^{-t}\, u(t)$?

(a) $\dfrac{1}{2}$ for $-\infty < \tau < \infty$

(b) $\dfrac{3}{2} e^{t-\tau}$ for $-\infty < \tau < \infty$

(c) $\dfrac{1}{2} e^{-2\tau}$ for $-\infty < \tau < \infty$

(d) $\dfrac{1}{2} e^{-|\tau|}$ for $-\infty < \tau < \infty$

139. The response of an LTI system to $u(t)$ is $g(t) = (2e^{-t} - e^{-5t})\, u(t)$

What is the response, when $x(t) = 1$?

(a) 0 (b) 2

(c) 5 (d) 7

140. What is the value of $x(t)$ for $t > 0$ from the given Laplace transform?

$$X(s) = \frac{s^2 + 3s + 3}{(s+1)(s-2)(s+5)}$$

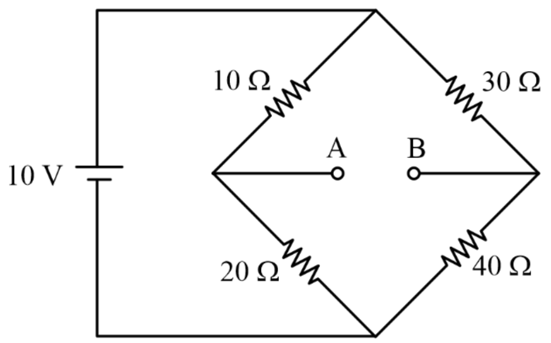
(a) $\dfrac{1}{5} + \dfrac{2}{3} e^{-3t}$

(b) $-\dfrac{1}{12} e^{-t} + \dfrac{13}{21} e^{2t}$

(c) $\dfrac{1}{12} e^{t} + \dfrac{13}{21} e^{-2t} + \dfrac{13}{28} e^{5t}$

(d) $-\dfrac{1}{12} e^{-t} + \dfrac{13}{21} e^{2t} + \dfrac{13}{28} e^{-5t}$

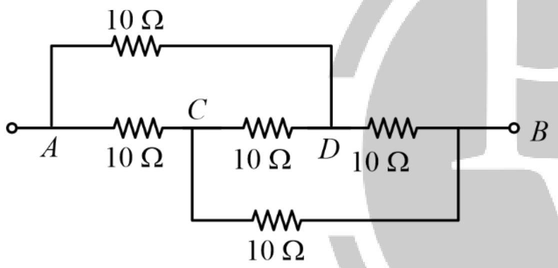
141. What is the value of V_{AB} in the network shown in the figure?



(a) 0.86 V (b) 0.96 V

(c) 0.66 V (d) 0.76 V

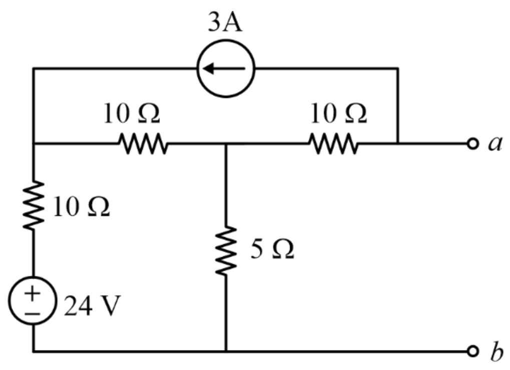
142. Five resistances of 10 Ω each are connected between terminals *A* and *B* as shown in the figure. What is the total resistance between terminals *A* and *B*?



(a) 5 Ω (b) 10 Ω

(c) 15 Ω (d) 20 Ω

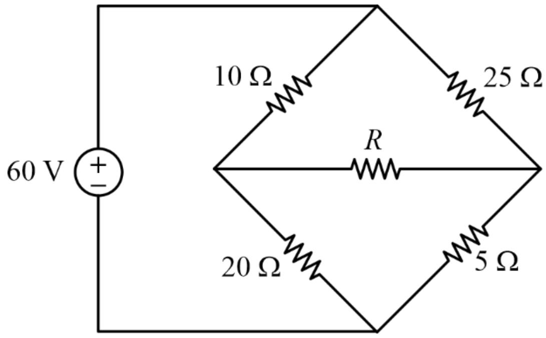
143. The Thevenin equivalent circuit voltage and resistance for the given circuit between terminals a and b are respectively



(a) 49.2 V, 10 Ω (b) –49.2 V, 15 Ω

(c) –49.2 V, 20 Ω (d) 49.2 V, 20 Ω

144. What is the maximum power that can be delivered to the variable resistor *R* in the circuit?



(a) 15.77 W (b) 18.77 W

(c) 19.77 W (d) 20.77 W

$v_{ab} = V_{th} = 40 - 10 = 30$ V

145. Consider the following statements regarding the initial conditions for inductor and capacitor :

1. If there is no current flowing through the inductor at $t = 0^-$, the inductor will act as an open circuit at $t = 0^+$.
2. If there is no voltage across the capacitor at $t = 0^-$, the capacitor will act as an open circuit at $t = 0^+$.
3. If a current of value I_0 flows through the inductor at $t = 0^-$, the inductor can be regarded as a current source of I_0 ampere at $t = 0^+$.

Which of the above characteristics is/are not correct?

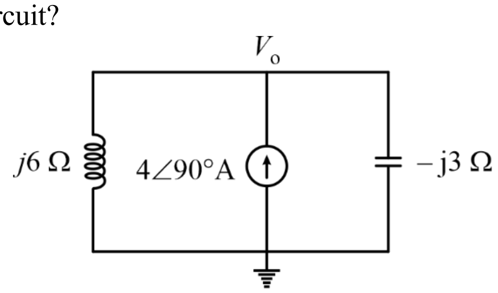
(a) 1 only

(b) 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

146. What is the value of voltage V_0 shown in the circuit?



(a) –8 V (b) 8 V

(c) 24 V (d) –24 V

147. The value of the power consumed by the balanced star-connected load in terms of the balanced delta-connected load is

(a) $P_Y = \left[\frac{P_\Delta}{\sqrt{3}}\right]$ (b) $P_Y = \left[\sqrt{3}\, P_\Delta\right]$

(c) $P_Y = \left[\frac{P_\Delta}{3}\right]$ (d) $P_Y = \left[3\, P_\Delta\right]$

148. The Z parameters of a two-port network are

$Z_{11} = 20\ \Omega$, $Z_{22} = 30\ \Omega$, $Z_{12} = 21 = 10$

The corresponding values of ABCD parameters are

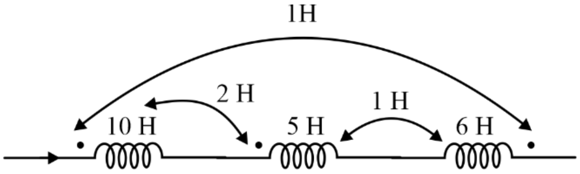
(a) $\begin{bmatrix} 2 & 0.1 \\ 50 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 3 & 50 \\ 0.1 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & 40 \\ 0.1 & 3 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & 50 \\ 0.1 & 3 \end{bmatrix}$

149. What is value of equivalent inductance of the network shown in the figure?

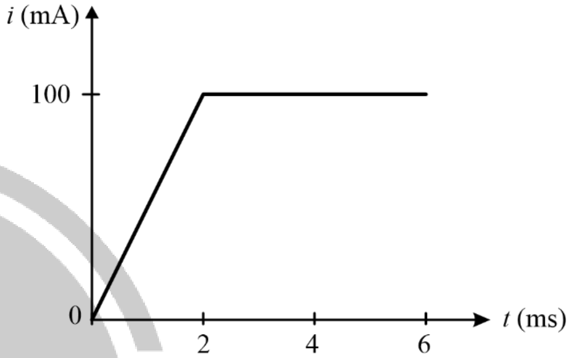


(a) 19 H (b) 21 H

(c) 23 H (d) 25 H

150. An initially uncharged 1 mF capacitor has the current shown in the figure.

What is the voltage across it at $t = 2$ ms?



(a) 50 mV (b) 100 mV

(c) 200 mV (d) 250 mV

ELECTRICAL ENGINEERING

ANSWER KEY

1	(a)	**16**	(a)	**31**	(c)	**46**	(b)	**61**	(*)	**76**	(*)	**91**	(c)	**106.**	(a)	**121.**	(*)	**136.**	(c)
2	(a)	**17**	(c)	**32**	(c)	**47**	(a)	**62**	(b)	**77**	(*)	**92**	(b)	**107.**	(d)	**122.**	(a)	**137.**	(*)
3	(b)	**18**	(b)	**33**	(a)	**48**	(c)	**63**	(d)	**78**	(*)	**93**	(a)	**108.**	(b)	**123.**	(a)	**138.**	(d)
4	(c)	**19**	(c)	**34**	(b)	**49**	(c)	**64**	(c)	**79**	(*)	**94**	(b)	**109.**	(b)	**124.**	(a)	**139.**	(a)
5	(d)	**20**	(c)	**33**	(b)	**50**	(b)	**65**	(a)	**80**	(*)	**95**	(a)	**110.**	(d)	**125.**	(b)	**140.**	(d)
6	(a)	**21**	(b)	**36**	(b)	**51**	(c)	**66**	(d)	**81**	(*)	**96**	(b)	**111.**	(c)	**126.**	(a)	**141.**	(b)
7	(c)	**22**	(a)	**37**	(b)	**52**	(c)	**66**	(c)	**82**	(*)	**97**	(a)	**112.**	(a)	**127.**	(b)	**142.**	(b)
8	(a)	**23**	(c)	**38**	(c)	**53**	(c)	**68**	(c)	**83**	(*)	**98**	(b)	**113.**	(c)	**128.**	(a)	**143.**	(c)
9	(a)	**24**	(a)	**39**	(d)	**54**	(a)	**69**	(a)	**84**	(*)	**99**	(c)	**114.**	(a)	**129.**	(a)	**144.**	(d)
10	(b)	**25**	(c)	**40**	(d)	**55**	(a)	**70**	(d)	**85**	(a)	**100**	(*)	**115.**	(a)	**130.**	(a)	**145.**	(c)
11	(a)	**26**	(b)	**41**	(b)	**56**	(d)	**71**	(c)	**86**	(d)	**101.**	(d)	**116.**	(a)	**131.**	(*)	**146.**	(c)
12	(a)	**27**	(a)	**42**	(d)	**57**	(b)	**72**	(a)	**87**	(*)	**102.**	(a)	**117.**	(a)	**132.**	(b)	**147.**	(c)
13	(c)	**28**	(b)	**43**	(b)	**58**	(d)	**73**	(c)	**88**	(b)	**103.**	(d)	**118.**	(d)	**133.**	(a)	**148.**	(d)
14	(a)	**29**	(a)	**44**	(a)	**59**	(b)	**74**	(a)	**89**	(d)	**104.**	(c)	**119.**	(a)	**134.**	(b)	**149.**	(b)
15	(c)	**30**	(d)	**45**	(b)	**60**	(c)	**75**	(c)	**90**	(d)	**105.**	(d)	**120.**	(a)	**135.**	(b)	**150.**	(b)

SOLUTIONS

1. (a)

Dobule dta rate

$f = 400$ mtz $\rightarrow T = 1/f = 0.01\mu s$

Data bus = 64 bit

Double $\rightarrow$ Luice

0.01 s $\rightarrow$ 128 bits

0.01 μs $\rightarrow$ 16 byts

$1 \text{ sec} \rightarrow \dfrac{16}{0.01\times10^{-6}}$

$= \dfrac{16}{0.01}\times10^{6} = 1600\,\text{MB/s}$

$0.01\mu s \rightarrow$ It sends 64

i.e., 2 × 64 = 1

2. (a)

RPM = 6000

60 ec $\rightarrow$ 6000

1 sec $\rightarrow$ 100 rotations1 rotation

$= \dfrac{1}{100}\text{sec} = 0.01\text{sec}$

= 10 m sec

For half head $= \dfrac{10\text{ms}}{2}$

= 5 msec

0.005 sec

3. (b)

Capacity of disk = 2 MB.

Capcity of each page = 2 KB.

Number of pages $= \dfrac{2MB}{2KB} = \dfrac{2\times2}{2\times2} = 2 = 1024$

4. (c)

Lagging

5. (d)

Zero capcity

6. (a)

7. (c)

8. (a)

9. (a)

10. (b)

11. (a)

$g_{mx} = \dfrac{V}{r\ln R/r}$

$g_{mx} = \dfrac{V}{r}$

$r = \dfrac{80}{60} = 1.333$

$d = 2.66$

$\ln\dfrac{R}{r} = 1$

$\dfrac{R}{r} = C$

$R = 1.33\ e$

$d = 2.66\ e$

12. (a)

13. (c)

14. (a)

Breaking current $= \dfrac{2000\sqrt{3}\times10^{6}}{\sqrt{3}\times20\times10^{3}} = 100\,\text{kA}$

Making urrent = 2.55 × 100 = 255 kA

15. (c)

16. (a)

Lap will have number of parallel path = Number of poles is suitable for high current and low voltage.

17. (c)

Interdoles windinges are connected in series with armature w/d

18. (b)

$I \propto I_a^2 \propto N^2$

$I_a \propto N$

$I_{a_2} = \dfrac{N_2}{N_1}\times 50$ Let = 50 x

$\dfrac{N_2}{N_1}\left[\dfrac{V - I_{a_2}(R_a + R_{se} + R_{ent})}{V - I_{a_1}(R_a + R_{se})}\right] \propto \left[\dfrac{I_{a_1}}{I_{a_2}}\right]$

$x = \left(\dfrac{250 - 50\times x\times 5}{250 - 50\times 0.6}\right) \propto \dfrac{1}{x}$

$220x^2 = 250 - 250x$

$x = 0.63978, -1.77$

$\frac{N_2}{N_1} = x = 0.639789$

$N_2 = 639.78 \cong 640$ r.p.m.

19. **(c)**

N_s = 1800 rpm as 60 Hz and no load

N_r = 1650 rpm speed

- Speed of rotor flux w.r.t rotor fold = $N_s - N_r$ = 150 rpm
- Speed of roto flux w.r.t stator flux = $N_s - N_s$ = 0 r.p.m.

20. **(c)**

$P_d = (1-8)P_g$ = (1 – 0.1) × 100 k.W = 90 k.W.

21. **(b)**

Voltage requlation

$= \frac{V_{nL} - V_{fL}}{V_{rated}} = \frac{2400-3000}{3000} = -20\%$

22. **(a)**

Change in encitation only effects reaction power and power factor since the alternator encitation is increase. So its reactive power supplied woudl increase. Increases and for power factor initial operation must be known.

23. **(c)**

Synchronous motor is under encited operates at lagging power factor and in overenuted mode it will operates at leading power factor

Hence, the correct option is (c)

24. **(a)**

P.M stepper motor → 300 pulses per sec

Variable reluctance motor → 1200 pulses per sec.

25. **(c)**

For ideal transform care permeability is infinite.

26. **(b)**

1, 2 are not correct

27. **(a)**

CISC is more feasble

28. **(b)**

Pippelining

29. **(a)**

30. **(d)**

31. **(c)**

$H = 10\frac{kW-\sec}{kVA} = 10\frac{N\omega-\sec}{MVA}$

$K.E = GH = 30 \times 10 = 300\ M\omega - \sec = 300$ mT

32. **(c)**

33. **(a)**

34. **(b)**

35. **(b)**

$P = \frac{735.J}{75} \times 1370 \times 324$ kW

P = 4352 MW

36. **(b)**

- Diode requires small positive voltage to enter into conductivity region and that voltage is cut-in-voltage.
- In R.B. mode, reverse saturation current flows from n to p.
- Breakdown occurs in R.B. mode for large breakdown voltage.

37. **(b)**

Intrinsic conductivity, $\sigma_i = qn_i\,[\mu_n + \mu_p]$

$\sigma_i = 1.6 \times 10^{-19} \times 1.5 \times 10^{10} \times 1800$

$\sigma_i = 4.32 \times 10^{-6}$ S/cm

38. **(c)**

With increase in R.B. voltage depletion region width,

$W = \sqrt{\frac{2\in}{q}\left(\frac{1}{N_A} + \frac{1}{N_D}\right)(V_o + V_R)}$ increase

and $C_j = \frac{\in A}{W}$, as W↑ with V_R therefore,

C_j decreases with increase in R.B. Voltage.

39. **(d)**

40. **(d)**

Initially at T = 300 K

$E_C - E_F = 0.3\text{ eV} = KT\ln\frac{N_C}{N_D} = K \times 300\ln\frac{N_C}{N_D}$

Now, at T = 360 K

$(E_C - E_F)_{360} =$

$K \times 360\ln\frac{N_C}{N_D} = \frac{360}{300} \times K \times 300\ln\frac{N_C}{N_D}$

$= \frac{360}{360} \times 0.3\text{ eV} = 0.36\text{ eV}$

41. **(b)**

42. **(d)**

In active region of operation: Base emitter junction is F.B. while Collector Base junction in R.B.

43. **(b)**

44. **(a)**

45. **(b)**

46. **(b)**

⇒ current = 10.03, 10.11 ; 10.08

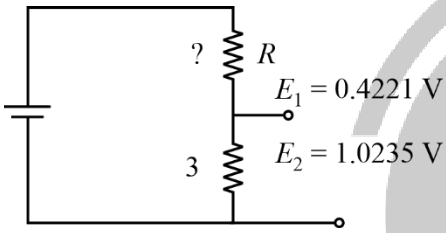
$$\text{Average} = \frac{10.3+10.10+10.11+10.08}{4} = 10.08 \text{ A.}$$

Range of error = Maximum – Minimum

= 10.08 – 10.03 = 0.05

≃ 0.04 A close st.

47. **(a)**



$$\frac{E_1}{E_2} = \frac{R}{5}$$

$R = 0.412408\ \Omega$

$$I = \frac{E_1}{R} = \pm 10.235\text{A}$$

48. **(c)**

$l \times b = 40 \times 30 \times 10^{-6}\ m^2$

$N = 100$

$T_C = 240 \times 10^{-6}$ N-m; θ = 100 divisions;

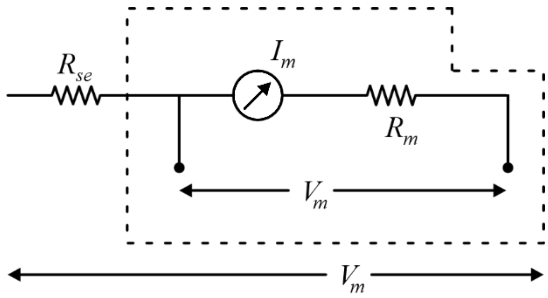
$B = 1.0$ Wb/m^2 1volt per division

So per Δ 00 division = 100V

First find I = ?

BINA = T_C

$$I = \frac{T_C}{\text{BNA}} = \frac{240\times10^{-6}}{1\times100\times40\times30\times10^{-6}}$$



$I = 2$mA

$V_m = 1$ volt

$V = 100$ volt

$$R_m = \frac{V_m}{I_m} = \frac{1}{2\times10^{-3}}$$

= 0.5 kΩ

$$R_{se} = R_m[m-1]$$

$$R_{se} = R_m\left[\frac{V}{Vm} - 1\right]$$

$$= 500[100-1]$$

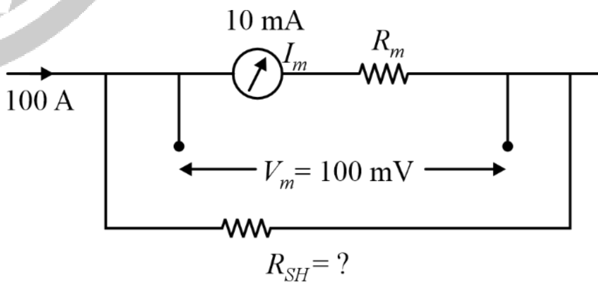
= 500 × 99

≃ 50 kΩ

49. **(c)**

It indicates the higher value of m/m for descending values.

50. **(b)**



$V_m = I_m R_m$

$$R_m = \frac{100mV}{10mA} = 10\Omega$$

$$R_{sb} = \frac{R_m}{m-1} = \frac{R_m}{I/I_m - 1} = \frac{10}{\frac{100}{10\times10^{-3}} - 1}$$

= 1 m Ω

= 0.001 Ω

ELECTRICAL ENGINEERING

51. **(c)**

W_1 ; W_2

When $\phi = 90^\circ \rightarrow \cos\phi = 0^\circ$

$W_1 = V_L I_L \cos(30 - \phi) \Rightarrow V_L I_L/2$

$W_2 = V_L I_L \cos(30 + \phi) \Rightarrow -V_L I_L/2$

But here magnetise are same

When $\phi = 60^\circ \rightarrow \cos\phi = 0.5$

$$W_1 = \frac{\sqrt{3}}{2} V_L \ I_L$$

$W_2 = 0$

one meter zero

So Answer must be lens than 0.5 to zero.

52. **(c)**

Frequenagmetes Range 50 Hz – 1kHz

53. **(c)**

$$r_{31/2110} = \frac{10}{10^3} = 0.01$$

error in 1 digit = ± 0.01[1] = 0.01

Reading = 5V

$$\text{error} = \pm\, 0.5\%\ \text{Reading} = \pm\left[\frac{0.5}{100} \times 5\right] = \pm 0.025$$

Total error = ±[0.025 + 0.01] = 0.035

54. **(a)**

For a PoT based Recorders

$S = 4$ mv/mm

error = less than ± 0.25%

$B.W = 0.8$ Hz

55. **(a)**

Bandwidth = $0.35/t_r$

$$t_r = \frac{0.35}{BW} = \frac{0.35}{10\text{nHz}} = 0.035\,\mu\text{sec}$$

$$= 35\text{n sec}$$

56. **(d)**

57. **(b)**

If $R_L \gg R_0$ Then it is voltage source

58. **(d)**

$\frac{u}{f} \neq$ constant i.e., $B_m \neq$ constant

But $\frac{u}{f} \propto B_m$

i.e., $P_h \propto \frac{V^{1.6}}{f^{0.6}}$ & $P_e \propto V^2$

i.e., hysteresis loss increases with decreases in frequency while eddy current loss remain same.

59. **(b)**

$$P_{input} = \sqrt{3} \times V_L I_L \cos\phi = P_{out/\eta}$$

$$I_L = \frac{P_{out/\eta}}{\sqrt{3} \times V_L \times \cos\phi}$$

$$I_L = \frac{30/0.9}{\sqrt{3} \times 415 \times 0.833} = 55.67\text{A}$$

$$S = \sqrt{3} V_L I_L \cong 40\text{kVA.}$$

60. **(c)**

Due to conductance power transfer K.V.A capacity of also transformer is more than

$$S_{auto} = S_{2-w/d} = \left(\frac{1}{a_{auto}}\right) \times S_{auto}$$

$$S_{auto} = \left(\frac{a_{auto}}{a_{auto} - 1}\right) S_{2-w/d} \Bigg| a_{auto} = \frac{V_H}{V_L}$$

61. **(*)**

$$f = \frac{1}{2\pi RC}$$

$$C = \frac{1}{2\pi f R} = 1.592\text{nF}$$

62. **(b)**

63. **(a)**

64. **(c)**

65. **(a)**

Due to SiO_2 its input resistance is high.

66. **(d)**

67. **(c)**

68. **(c)**

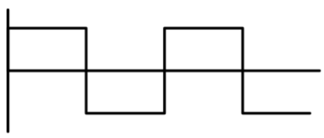
Load must be low so inductor is not saturated.

69. **(a)**

70. **(d)**

71. **(c)**

72. **(a)**



73. **(c)**

74. **(a)**

75. **(c)**

Its input impedance is high not low.

76. **(*)**

77. **(*)**

78. **(*)**

79. **(*)**

80. **(*)**

81. **(*)**

82. **(*)**

83. **(*)**

84. **(*)**

85. **(a)**

$E_1 \rightarrow$ Event that 6 does not appear in first throw.

$E_2 \rightarrow$ Event that more than four throws are necessary for first 6.

$$P[E_1] = \frac{5}{6}$$

$$P\left[\frac{E_2}{E_1}\right] = \left[\frac{P(E_1 \cap E_2)}{P[E_1]}\right]$$

$P[E_1 \cap E_2]$ = First 6 in 5^{th} throw or first 6 in 6^{th} throw or

$$= \left(\frac{5}{6}\right)^4 \cdot \frac{1}{6} + \left(\frac{5}{6}\right)^5 \cdot \frac{1}{6} + \left(\frac{5}{6}\right)^6 \cdot \frac{1}{6} + \ldots$$

Now,

$$P\left[\frac{E_2}{E_1}\right] = \frac{\left(\frac{5}{6}\right)^4 \cdot \frac{1}{6} + \left(\frac{5}{6}\right)^5 \cdot \frac{1}{6} + \left(\frac{5}{6}\right)^6 \cdot \frac{1}{6} + \ldots}{5/6}$$

$$= \left(\frac{5}{6}\right)^3 \cdot \frac{1}{6}\left[1 + \frac{5}{6} + \left(\frac{5}{6}\right)^2 + \ldots\infty\right]$$

$$= \left(\frac{5}{6}\right)^3 \cdot \frac{1}{6} \cdot \frac{1}{\left(1 - \frac{5}{6}\right)} = \left(\frac{5}{6}\right)^3 = \frac{125}{216}$$

86. **(d)**

$$P[A] = P\left[\frac{B}{A}\right] = \frac{1}{2} \Rightarrow P\left[\frac{B}{A}\right] = P[B] = \frac{1}{2}$$

$$P[A \cup B] = P[A] + P[B] - P[A \cap B]$$

$$P[A \cap B] = P[A] \times P[B/A] = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$P[A \cup B] = \frac{1}{2} + \frac{1}{2} - \frac{1}{4} = \frac{3}{4}$$

87. **(*)**

88. **(b)**

For converting SR ff into JK FF we use transformation $S = J\,\bar{Q}$ & $R = KQ$ and that is done through NAND gates.

89. **(d)**

1 : 8 DeMux can be written as

1 : 2^3 DeMux and for this we require 3 selection.

90. **(d)**

For n-bit flash type ADC we require :

↙ $(2^n - 1)$ comparators using OPAMS

↘ 2^n Resistance

91. **(c)**

The materials to be used to build permanent magnet. Should have high permeability, high coercivity and should have high curie temperature.

92. **(b)**

Soft ferromagnetic material is used as cure of transofmer. It should has high permeability and low hyseresis and eddy current loss.

93. **(a)**

Si diode	0.6 to 0.7 volt
Schottky diode	0.2 V
LED	1.4V to 4V

94. **(b)**

If any impurity is added, it becomes extrinsic semiconductor. When it is havily doped, it almost acts like a conductor and referred to as degenerate.

95. **(a)**

Opto isolators contains LED and and photo diode or photo transistors in one package and they are for low DC-coupling.

96. (b)

Material	Critical Temperature
Aluminimum	1.2 K
Inercury	4.15 K
Lead	7.2 K

97. (a)

Organic superconductors are composed of organic molecules which are electron donor and has non organic anion which is electron acceptor.

98. (b)

$$x[n]=\sin c\left(\frac{\omega_c n}{\pi}\right)$$

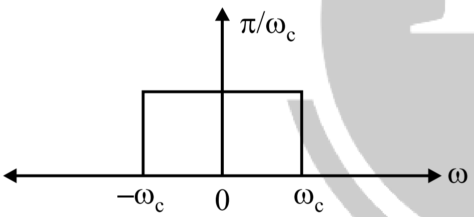
$$\Rightarrow \quad x[n]=\frac{\sin(\omega_c n)}{\omega_c n.\pi}\times\pi$$

$$\Rightarrow \quad x[n]=\frac{\pi}{\omega_c}.\frac{\sin(\omega_c n)}{\pi n}$$

$\updownarrow$ *DIFT*

$$\Rightarrow \quad X\left[e^{j\omega}\right]$$

$\Rightarrow$



$$\Rightarrow \quad E_{x[n]}=\frac{1}{2\pi}\times\left[\frac{\pi^2}{\omega_c^2}\times 2\omega_c\right]$$

$$\Rightarrow \quad \boxed{E_{x[n]}=\frac{\pi}{\omega_c}}$$

99. (c)

$$x[n]=\left\{-1,0,1,\underset{\uparrow}{2},1,0,1,2,,1,0,-1\right\}$$

$$\Rightarrow \quad \sum_{n=-\infty}^{n=\infty}\left|n.x[n]\right|^2=\frac{1}{2\pi}.\int_{-\pi}^{\pi}\left|\frac{d}{d\omega}\times\left[e^{j\omega}\right]^2.d\omega\right|$$

$$\Rightarrow \quad I=\int_{-\pi}^{\pi}\left|\frac{d\times\left[e^{j\omega}\right]}{d\omega}\right|^2 d\omega=2\pi.\sum_{n=-\infty}^{n=\infty}\left|n.x(n)\right|^2$$

$$\Rightarrow \quad I=\left[\begin{pmatrix}(-3)\times(-1)^2+(-2\times 0)^2+\\(-1\times 1)^2+(0\times 2)^2+(1\times 1)^2\\+(2\times 0)^2+(3\times 1)^2+(4\times 2)^2\\+(5\times 1)^2+(6\times 0)^2+(7\times -1)^2\end{pmatrix}\right].2\pi$$

$$\Rightarrow \quad I=\begin{pmatrix}9+0+1+0+1+0\\+9+64+25+0+49\end{pmatrix}.2\pi$$

$$\Rightarrow \quad I=2\pi\times 158=316\pi$$

$$\Rightarrow \quad \boxed{I=316\pi}$$

100. (?)

Given

$$X\left[e^{j\omega}\right]=2j \quad i \qquad 0<\omega\le\pi$$
$$=-2j \quad i \qquad -\pi<\omega\le 0$$

$$\Rightarrow \quad x[n]=\frac{1}{2\pi}.\int_{-\pi}^{\pi}X\left[e^{j\omega}\right].e^{j\omega n}.d\omega$$

$$\Rightarrow \quad x[n]=\frac{1}{2\pi}.\int_{-\pi}^{0}(-2j).e^{j\omega n}.d\omega+\frac{1}{2\pi}.$$

$$\int_{0}^{\pi}2j.e^{j\omega n}.d\omega$$

$$\Rightarrow \quad x[n]=\frac{-j}{\pi}.\left(\frac{e^{j\omega n}}{jn}\right)_{-\pi}^{0}+\frac{j}{\pi}.\left(\frac{e^{j\omega n}}{jn}\right)_{0}^{\pi}$$

$$\Rightarrow \quad x[n]=\frac{-j}{\pi}.\left[\frac{1-e^{-j\pi n}}{jn}\right]+\frac{j}{\pi}.\left[\frac{e^{+j\pi n}-1}{jn}\right]$$

$$\Rightarrow \quad x[n]=\frac{-j}{\pi}\left[\frac{1-(-1)^n}{jn}\right]+\frac{j}{\pi}\left[\frac{(-1)^n-1}{jn}\right]$$

$$\Rightarrow \quad x[n]=\frac{1}{\pi n}.\left[(-1)^n-1-1+(-1)^n\right]$$

$$\Rightarrow \quad x[n]=\frac{2}{\pi n}.\left[(-1)^n-1\right]$$

$$\Rightarrow \quad x[n]=\frac{2}{\pi n}.[\cos\pi n-1]$$

$$\Rightarrow \quad x[n]=-\frac{4}{\pi n}.\sin^2\left(\frac{\pi}{2}n\right)$$

101. (d)

$$x[n]=\delta[n-01]+\delta[n+1]$$

$$\Rightarrow \quad X\left[e^{j\omega}\right]=\sum_{n=-\infty}^{n=\infty}x[n].e^{-j\omega n}$$

$\Rightarrow \quad X\left[e^{j\omega}\right] = \sum_{n=-\infty}^{n=\infty} \delta[n-1].e^{-j\omega n} +$

$\sum_{n=-\infty}^{n=\infty} \delta[n+1].e^{-j\omega n}$

$\Rightarrow \quad X\left[e^{j\omega}\right] = e^{-j\omega} + e^{j\omega} = 2\cos\omega$

$\Rightarrow \quad \boxed{X\left[e^{j\omega}\right] = 2\cos\omega}$

102. (a)

$x[n] = \cos(\omega_0 n).\mu[n]$

$X\left[e^{j\omega}\right] = \dfrac{2\pi\left[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)\right]}{2}$

$\Rightarrow \quad \boxed{X\left[e^{j\omega}\right] = \pi\left[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)\right]}$

103. (d)

Given,

$y[s] = \dfrac{10(2s+3)}{s(s^2+2s+5)}$

(1) Initial value: y (0):

$\Rightarrow \quad y(0) = \lim_{t\to 0} y(t) = \lim_{s\to\infty} s.y[s]$

$\Rightarrow \quad y(0) = \lim_{s\to\infty} s.\dfrac{1(2s+3)}{s(s^2+2s+5)}$

$\Rightarrow \quad y(0) = \lim_{s\to\infty} \dfrac{\left(2+\frac{3}{s}\right)}{s+2+\frac{5}{s}}$

$\Rightarrow \quad \boxed{y(0) = 0}$

(2) Final value: y (∞)

$\Rightarrow \quad y(\infty) = \lim_{t\to\infty} y(t) = \lim_{s\to\infty} s.y[s]$

$\Rightarrow \quad y(\infty) = \lim_{s\to\infty} s.\dfrac{10(2s+3)}{s(s^2+2s+5)}$

$\Rightarrow \quad y(\infty) = \dfrac{10\times 3}{5} = 6$

$\Rightarrow \quad \boxed{y(\infty) = 6}$

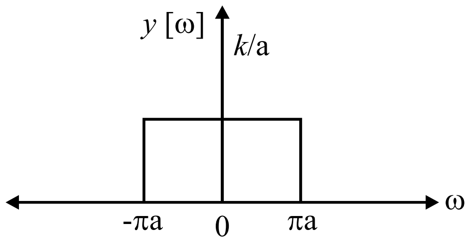
104. (c)

Given,

$x(t) = 10\sin c\left(\dfrac{t+4}{7}\right)$

$\Rightarrow \quad$ Let, $y(t) = k.\sin c(at) = k.\dfrac{\sin(\pi at)}{\pi at}$

$\Rightarrow \quad y[\omega]$



$\Rightarrow$

$\Rightarrow \quad$ Area of

$y(t) = \int_{-\infty}^{+\infty} y(t).dt = y[\omega]\big|_{\omega=0} = y[0]$

$\Rightarrow \quad$ Area of K. $\sin c(at) = \dfrac{k}{a}$

$\Rightarrow \quad$ Area of 10.$\sin c(t) = \dfrac{10}{1} = 10$

$\Rightarrow \quad$ Time shifting operation does not change area of signal.

$\Rightarrow \quad$ if $x(t) \longrightarrow Area = A$

$x(at) \longrightarrow Area = \dfrac{A}{|a|}$

$\Rightarrow \quad$ So, $\boxed{\text{Area of 10 } \sin c\left(\dfrac{t+4}{7}\right) = 10\times\dfrac{1}{\left|\frac{1}{7}\right|} = 70}$

105. (d)

$x(t) = \delta(3t) + \mu(3t)$

We know that $\delta(\alpha t) = \dfrac{1}{|\alpha|}.\delta(t)$ &

$\mu(\alpha t) = \mu(t)$

$\Rightarrow \quad x(t) = \dfrac{1}{3}\delta(t) + \mu(t)$

$\updownarrow LT$

$\Rightarrow \quad X[s] = \dfrac{1}{3} + \dfrac{1}{s}; \qquad$ Roc : Re {s} > 0

$\Rightarrow \quad \boxed{X[s] = \dfrac{s+3}{3s}; R(s) > 0}$

106. (a)

4-bit R-2R ladder:

Resolution is $= \dfrac{V_r}{2^n} = \dfrac{V_r}{2^4}$

ELECTRICAL ENGINEERING

$$\% \text{ resolution} = \frac{V_r/2^4}{V_r} \times 100\% = 6.25\%$$

107. (d)

- IN SAR type ADC conversion time is independent of input voltage and is always nT_{clk}. as average conversion time is small so they are comparatively faster.
- Output is in shift register [ring counter] and can be taken either in series or in parallel.

108. (b)

109. (b)

110. (d)

STA address → store the accumulator on address given.

It stores the content of accumulator on memory location whose address is given in instruction.

111. (c)

112. (a)

113. (c)

114. (a)

115. (a)

116. (a)

Isotropic material shows same electric properties for all the directions of applicance of electric field.

117. (a)

Resistivity of conductive materials ranges from 10^{-6} Ω-m to 10^{-8} Ω-m → Low resistivity and high conductivity.

118. (d)

Properties of good insulating material are

1. High dielectric strength
2. High volume resistivity
3. Low dissipation factor

119. (a)

120. (a)

Material	Curie Temperature
Iron	1043 K
Cobalt	1393 K
Nickel	631 K

121. (*)

122. (a)

123. (a)

124. (a)

$$K_p = \lim_{s \to 0} \frac{120(s+2)}{(s+3)(s+4)} = \frac{240}{12} = 20$$

$$e_{ss} = \frac{3}{1+K_p} = \frac{3}{21}$$

for $3 + u(t)$

$K_v = 0$

$$e_{ss} = \frac{3}{K_v} = \infty$$

for $3t^2u(t)$

$K_a = 0$

$e_{ss} = \infty$

125. (b)

$$K_v = \lim_{s \to 0} \frac{s100(s+2)(s+6)}{s(s+3)(s+4)} = \frac{100 \times 2 \times 6}{12} = 12$$

$$e_{ss} = \frac{4}{100} = \frac{1}{25}$$

126. (a)

127. (b)

s^5	1	4	2
s^4	2	6	5
s^3	$\frac{8-6}{2}=1$	$\frac{4-5}{2}=-\frac{1}{2}$	]
s^2			

128. (a)

129. (a)

130. (a)

131. (*)

132. (b)

133. (a)

134. (b)

135. (b)

136. (c)

137. (None of the a, b, c, d)

$$h(n) = e^{-\frac{n}{5}};\ 0 \le n \le N \ \ (\text{Take } N = 3)$$

$$\Rightarrow \quad h[n] = \left\{ \underset{\uparrow}{1}, e^{-1/5}, e^{-2/5}, e^{-3/5} \right\}$$

$$\Rightarrow \quad H[1] = 1 - j.e^{-1/5} - e^{-2/5} + j.e^{-3/5}$$

$$\Rightarrow \quad H[2] = 1 - e^{-1/5} + e^{-2/5} - e^{-3/5}$$

138. (d)

$x(t) = e^{-t}.u(t)$

ACF of $x(t) = x(\tau) = x(t) * x(-t)$

$\Rightarrow \quad F[x(\tau)] = X[\omega].X[-\omega]$

$= \dfrac{1}{1+j\omega}.\dfrac{1}{1-j\omega}$

$\Rightarrow \quad F[x(\tau)] = \dfrac{1}{\omega^2+1}$

$\Rightarrow$ We know that $e^{-|t|} \xleftrightarrow{FT} \dfrac{2}{\omega^2+1}$

$\Rightarrow \quad \dfrac{1}{2}.e^{-|t|} \xleftrightarrow{FT} \dfrac{1}{\omega^2+1}$

$\Rightarrow \quad \boxed{x(\tau) = \dfrac{1}{2}.e^{-|t|} \text{ for } -\infty < \tau < \infty}$

139. (a)

$x(t) = \mu(t) \rightarrow g(t) = (2e^{-t} - e^{-5t})\mu(t)$

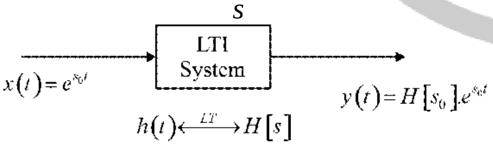
$\Rightarrow \quad TF = H[s] = \dfrac{G[s]}{X[s]}$

$\Rightarrow \quad G[s] = \dfrac{2}{s+1} - \dfrac{1}{s+5} = \dfrac{2s+10-s-1}{(s+1)(s+5)}$

$\Rightarrow \quad G[s] = \dfrac{s+9}{(s+1)(s+5)}$

$\Rightarrow \quad X[s] = \dfrac{1}{s}$

$\Rightarrow \quad TF = H[s] = \dfrac{\dfrac{s+9}{(s+1)(s+5)}}{\dfrac{1}{s}} = \dfrac{s(s+9)}{(s+1)(s+5)}$



$\Rightarrow$

$\Rightarrow$ given $x(t) = 1 = e^{0.t} = e^{s_0 t} \Rightarrow s_0 = 0$

$\Rightarrow \quad H[s]\big|_{s=s_0=0} = 0 \Rightarrow y(t) = 0.x(t)$

$\Rightarrow \quad \boxed{y(t) = 0}$

140. (d)

$X[s] = \dfrac{s^2+3s+3}{(s+1)(s-2)(s+5)}$

$\Rightarrow \quad X[s] = \dfrac{A}{s+1} + \dfrac{B}{s-2} + \dfrac{C}{s+5}$

$\Rightarrow \quad A = \dfrac{1-3+3}{(-3)\times(4)} = -\dfrac{1}{12}$

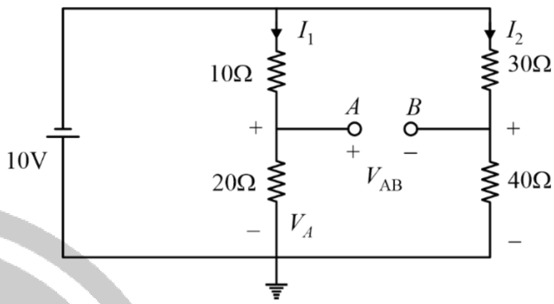
$\Rightarrow \quad B = \dfrac{4+6+3}{3\times 7} = \dfrac{13}{21}$

$\Rightarrow \quad C = \dfrac{25-15+3}{(-4)\times(-7)} = \dfrac{13}{28}$

$\Rightarrow \quad X[x] = \dfrac{-\dfrac{1}{12}}{s+1} + \dfrac{\dfrac{13}{21}}{s-2} + \dfrac{\dfrac{13}{28}}{s+5}$

$\Rightarrow \quad \boxed{x(t) = -\dfrac{1}{2}.e^{-t} + \dfrac{13}{21}.e^{2t} + \dfrac{13}{28}.e^{-5t}}$

141. (b)

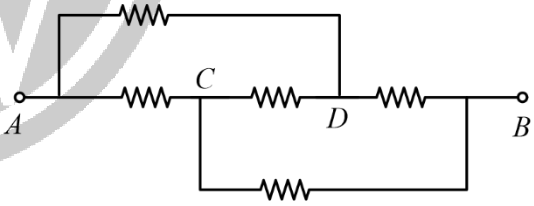


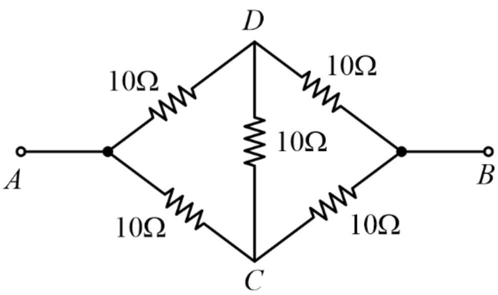
$v_A = \dfrac{20\times 10}{30} = \dfrac{200}{30} = 6.66V$

$v_B = \dfrac{10\times 40}{70} = \dfrac{40}{7} = 5.71$

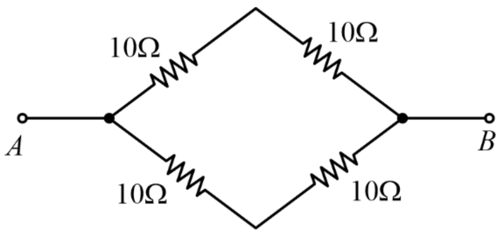
$v_{AB} = v_A - v_B = 6.66 - 5.71 = (0.95 \text{ V})$

142. (b)



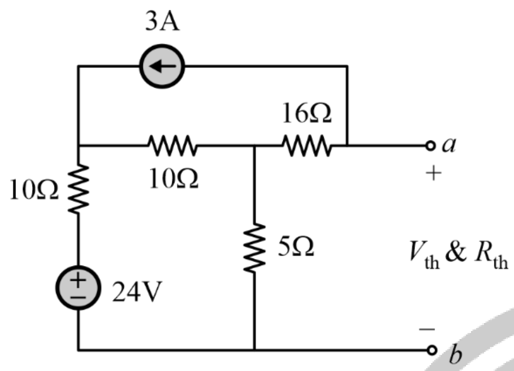


It is a balanced bridge have CD will be open

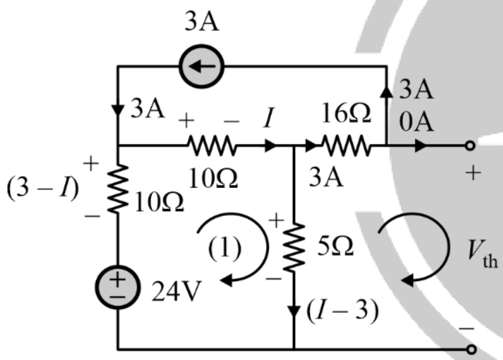


$$R_{AB} = \frac{20 \times 20}{40} = \frac{400}{40} = (10\Omega)$$

143. (c)



V_{th} calculation



KVL in loop (I)

$24 + 10\,(3 - I) - 10I - 5\,(I - 3) = 0$

$24 + 30 - 10\,I - 10\,I - 5.I + 15 = 0$

$25\,I = 69$

$I = \left(\frac{69}{25}\right) = 2.76A$

Now KVL in loop (2)

$5 \times (I - 3) = 16 \times 3 + V_{th}$

$V_{th} = 5I - 5 \times 3 - 16 \times 3$

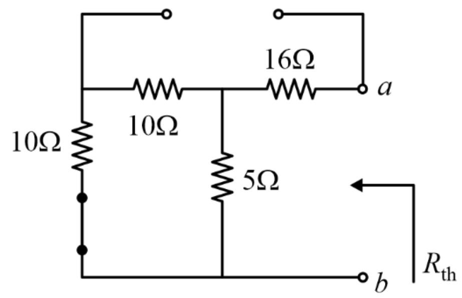
$= 13.8 - 15 - 48$

$V_{th} = (-49.2)\ V$

R_{th} calculation →

$I.VS \rightarrow S.C$

$I.C.S \rightarrow O.C$

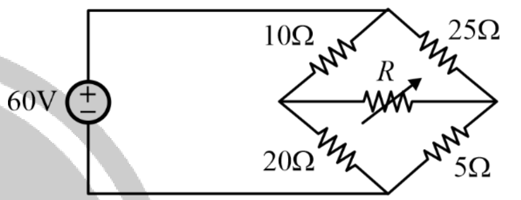


$R_{th} = (20 \parallel 5) + 16$

$= \frac{20 \times 5}{25} + 16$

$R_{th} = 20\Omega$

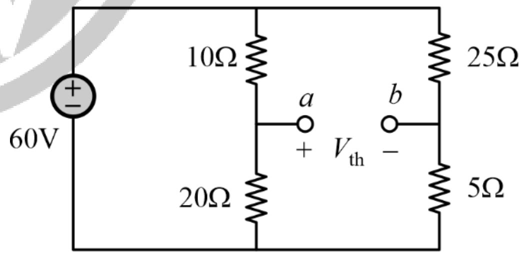
144. (d)



To get MPTT in R →

$P_{R(max)} = \frac{V_{th}^2}{4R_{th}}$

Calculation of V_{th} →



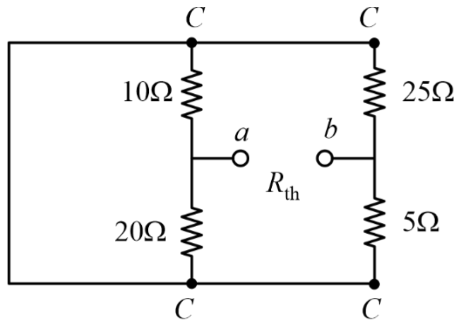
$v_a = \frac{60 \times 20}{30} = 40v$

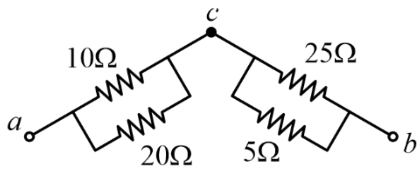
$v_b = \frac{60 \times 5}{30} = 10v$

$v_{ab} = V_{th} = 40 - 10 = 30\ V$

calculation of R_{th} →

IVS → S.C





$R_{th} = (20 \parallel 10) + (25 \parallel 5)$

$= \frac{20\times10}{30} + \frac{25\times5}{30}$

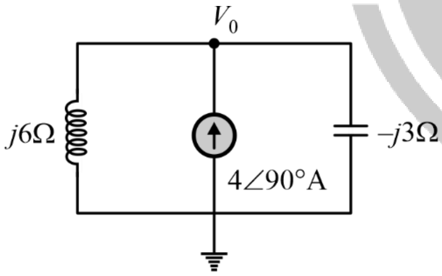
$= 6.66 + 4.16$

$= (10.826)\ \Omega.$

$$P_{R(\max)} = \frac{(30)^2}{4\times10.826} = (20.78w)$$

145. (c)

146. (c)



$$\bar{V_0}\left(\frac{1}{j6}+\frac{1}{-j3}\right) = 4\angle 90° = j4$$

$$\bar{V_0}\left(-\frac{j}{6}+\frac{j}{3}\right) = j4$$

$$\bar{V_0}\left(\frac{-j+2j}{6}\right) = j4$$

$$\bar{V_0}\left(\frac{-j}{6}\right) = j4$$

$$\bar{V_0} = 24\angle 0°\ \text{Volt}$$

147. (c)

star load is converted into delta load then the,

$P_\Delta = 3\ P_Y$

$$\left(P_Y = \frac{P_\Delta}{3}\right)$$

148. (d)

$$z = \begin{bmatrix} 20 & 10 \\ 10 & 30 \end{bmatrix}$$

$v_1 = 20\ I_1 + 10\ I_2$ ……(1)

$v_2 = 10\ I_1 + 30\ I_2$ ……(2)

For ABCD parameter

$v_1 = AV_2 - BI_2$ …..(3)

$I_1 = cu_2 - DI_2$ …..(4)

From equation (2)

$I_1 = \frac{V_2}{10} - \frac{30I_2}{10}$ ……(5)

Now comparing this with equation (4)

$\tau = \frac{1}{10},\ D = \frac{30}{10} = 3$

From equation (1) & (5)

$V_1 = 20 \times \left(\frac{V_2}{10} - 3I_2\right) + 10I_2$

$= 2V_2 - 60\ I_2 + 10\ I_2$

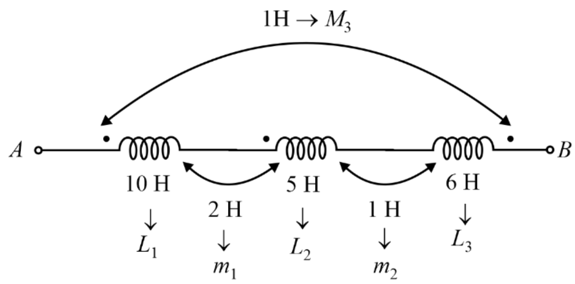
$V_1 = 2V_2 - 50\ I_2$ …….(6)

Comparing with equation (3)

$A = 2, B = 50$

$$[\text{ABCD}] = \begin{bmatrix} 2 & 50 \\ 0.1 & 3 \end{bmatrix}$$

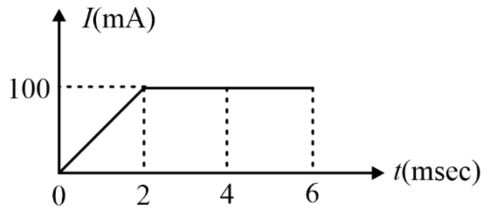
149. (b)

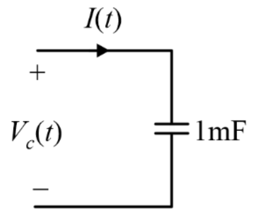


$L_{eq} = L_{AB} = L_1 + L_2 + L_3 + 2m_1 - 2\ m_2 - 2\ m_3$

$= 10 + 5 + 6 + 2 \times 2 - 2 \times 1 - 2 \times 1 = 21$ H

150. (b)





$$I(t) = c\frac{dv_c(t)}{dt}$$

$$v_c(t) = \frac{1}{c}\int_{0^+}^{dt} I_c(t)\,dt + v_c(0^+)$$

↓

OV

(Given)

$$V_c(t) = \frac{1}{1\times10^{-3}}\int_0^{2\times10^{-3}}(50t)dt$$

$$= \frac{50}{1\times10^{-3}}\left[\frac{t^2}{2}\right]_0^{2\times10^{-3}}$$

$$= \frac{50}{1\times10^{-3}}\times\frac{1}{2}[4\times10^{-6}]$$

$$V_c(t)\Big|_{t=2m\sec} = \frac{200\times10^{-6}}{2\times10^{-3}} = (100\times10^{-3})$$

$= (100$ m volt$)$

GATE WALLAH

SOLDIERS

THANK YOU