



NHPC JE

Electrical Engineering

Mega Mock Test

(April 02nd - April 3rd 2022)

Questions &
Solutions

1. A dual trace CRO has
 - A. 3-electron gun and two 2-pole switches
 - B. one electron gun and one 2-pole switch
 - C. 2 electron gun and one 2-pole switch
 - D. one electron gun and two 2-pole switch

Ans. B

Sol. In a dual trace CRO has one electron gun and one two pole switch. The electronic switch passes one channel at a time into the vertical plate of CRO.

2. Temperature at which antiferromagnetic material converts to paramagnetic material is known as _____ temperature.
 - A. Curie
 - B. Curie-Weiss
 - C. Neel
 - D. Debye

Ans. C

Sol. Temperature at which antiferromagnetic material converts to paramagnetic material is known as Neel temperature.

3. Which of the following type of lamp gives more illumination from low wattage?
 - A. Incandescent lamp
 - B. Fluorescent lamp
 - C. Compact fluorescent lamp
 - D. LED lamp

Ans. D

Sol. Light-emitting diode (LED) lamps are fairly new to the general illumination scene. As technology continues to improve, they will become a great option.

- 1) LED lamps are available in a wide spectrum of colors (2700 being the closest to incandescent).
- 2) LED lamps are cool to the touch.
- 3) LED lamps are high efficiency.
- 4) LED can emit 300 lumens/watt
- 5) LED lamps have the longest life expectancy (50,000 hours).
- 6) LED lamps are expensive.

4. The expression for the transconductance for JEET is given by:

$$\begin{array}{ll}
 \text{A. } g_m = \frac{2I_{DSS}}{|V_p|} \left[1 - \frac{V_{GS}}{V_p} \right] & \text{B. } g_m = \frac{I_{DSS}}{|V_p|} \left[1 - \frac{V_{GS}}{V_p} \right] \\
 \text{C. } g_m = \frac{2I_{DSS}}{|V_{GS}|} \left[1 - \frac{V_{GS}}{V_p} \right] & \text{D. } g_m = \frac{2I_{OSS}}{V_{GS}} \left[1 - \frac{V_{GS}}{V_p} \right]^2
 \end{array}$$

Ans. A

Sol. Transconductance is given as: $g_m = \left. \frac{\Delta I_o}{\Delta V_{GS}} \right|_{Q\text{-point}} = \left. \frac{dI_o}{dV_{GS}} \right|_{Q\text{-point}}$

$$\text{Drain current, } I_D = I_{DSS} \left(1 - \frac{V_{GS}}{V_p} \right)^2$$

$$g_m = \frac{2I_{DSS}}{|V_p|} \left[1 - \frac{V_{GS}}{V_p} \right]$$

Here, $|V_p|$ denotes magnitude only to ensure a positive value of g_m .

5. State whether the following statements regarding electric traction are true or false.
- (a) Provision of a negative booster is essential in the case of electric traction.
 - (b) Communication lines that run parallel to the power supply lines of electric traction suffer from electrical interference.
- A. (a) False, (b) False B. (a) True, (b) True
C. (a) False, (b) True D. (a) True, (b) False

Ans. B

Sol. Provision of a negative booster is essential in the case of electric traction. By avoiding the flow of return currents through earth, it curtails corrosion of underground pipe work and interference with telegraph and telephone circuits.

6. Which of the following statement is not correct about squirrel cage and wound rotor motor of some power rating?
- A. Squirrel cage motor can be cooled better than a wound rotor motor
 - B. Squirrel cage motor is cheaper than a wound rotor motor
 - C. I^2R loss is lower in wound rotor motor
 - D. Maintenance charges of cage motor are lower

Ans. C

Sol. Cage rotor can be cooled better because of its bare end-rings. Wound-rotor motor is costlier than a cage motor as its construction requires slip rings, brushes short circuiting devices etc. A cage rotor requires considerably less conductor material than a wound rotor, consequently I^2R loss in cage rotor is less. Cage motor is more rugged as compared to wound rotor motor and it requires no slip rings, brushes etc., therefore its maintenance charges are lower.

7. Which one of the following heating method is most inefficient method of electrical heating?
- A. Infrared Heating B. Resistance Heating
 - C. Dielectric Heating D. Induction Heating

Ans. A

Sol. Infrared Heating is the most inefficient method of electric heating. It is also the simplest form of electric heating. Here the electromagnetic radiation coming out from an incandescent light bulb is focused to the surface to be heated. It is mostly used for drying out the wet painted surface of an object.

8. A 400 V, 20 kW, 6 pole induction motor has full load slip of 5%. The induction motor has full load slip is:
- A. 190.98 Nm B. 201 Nm
 - C. 21 Nm D. 245 Nm

Ans. B

Sol. Synchronous speed, $N_s = \frac{120 \times 50}{6} = 1000$ rpm

Rotor speed, $N_r = N_s(1 - s) = 1000(1 - 0.05) = 950$ rpm

Torque developed,

$$T = \frac{P}{\omega_r} = \frac{20 \times 10^3}{2\pi \times \frac{950}{60}} = 201.03 \text{ Nm}$$

9. Arc produced in the circuit Breaker is _____

- A. Positive temperature coefficient
- B. Negative temperature coefficient
- C. Not varies with temperature
- D. None

Ans. B

Sol. \Rightarrow Arc produced in the circuit breaker has negative temperature coefficient as temperature increases arc resistance decreases

\Rightarrow The conductance of the Arc is directly proportional to the no. of free electron generated during ionization

\Rightarrow The conduction of the Arc is directly proportional to the cross-section area of the arc.

\Rightarrow Conduction of the Arc is inversely proportional to the length of Arc.

10. Dissipation factor, $\tan \delta$, of a capacitor is measured by which bridge?

- A. Anderson bridge
- B. Hay bridge
- C. Schering bridge
- D. Wien bridge

Ans. C

Sol. Schering bridge is used to determine the Dissipation factor, $\tan \delta$, of a capacitor is measured by which bridge?

11. Which type of earthing is suitable in transmission lines

- A. Rod earthing
- B. pipe earthing
- C. strip earthing
- D. plate earthing

Ans. C

Sol. **Strip and Wire earthing** :This earthing is done in a place where the ground is rocky which means there is more rock in the ground. This earthing is widely used in long-distance transmission lines

Rod Earthing: This type of earthing is done by digging very deep in the sandy area as the moisture content is high across the sandy place. That's why we use Pipe Earthing in this

Pipe Earthing: This is the most commonly used earthing in which we put a pipe 5 to 10 feet into the ground

Plate Earthing is considered to be the best earth. This is used in substation and power station Plate Earthing Nose. Such earthing is used in places where a large number of current flows

Coil earthing is used in the smallest amount. This earthing uses a coil made of G.I wire. Such earthing is mostly used for electric poles.

12. When bundle of conductors are used in place of single conductors the effective inductance and capacitance will, respectively
- A. Increase and decrease
 - B. Decrease and increase
 - C. Decrease and remain unaffected
 - D. Increase and remain unaffected

Ans. B

Sol. When a bundle conductors are used in transmission line the self GMD of the conductors is increased, so the inductance per phase of the conductor decreases. Bundled conductors will have higher capacitance to neutral when compared to single lines.

13. A synchronous phase modifier supplies which of the following power?
- A. Inductive reactive power only
 - B. Active power only
 - C. Both active and reactive power
 - D. Both lagging and leading reactive power

Ans. D

Sol. SPM is a synchronous motor operating under no load conditions under variety of excitation. Depending on load, it may be overexcited (supplies lagging VAR) or under-excited (supplies leading VAR)

14. Two insulations discs of identical capacitance value C make up a string for 2 kV, 50 Hz, single phase head line insulation system. If pin to earth capacitance is also C, then what is the string efficiency?
- A. 50%
 - B. 75%
 - C. 90%
 - D. 80%

Ans. B

Sol. $k = \frac{\text{pin to earth capacitance}}{\text{self capacitance}} = \frac{C}{C} = 1$

$$V_2 = V_1(1 + k) = 2V_1$$

$$\text{String efficiency} = \frac{\text{operating phase voltage } (V_{ph})}{n \times \text{voltage of disc nearest to conductor}}$$

$$\eta = \frac{V_1 + V_2}{2 \times V_2} = \frac{3V_1}{4V_1} \times 100 = 75\%$$

15. Which of the following statement is wrong regarding class C amplifier.
- A. Conduction angle for transistor is less than 180°
 - B. It has very poor linearity
 - C. It is suitable for use as audio amplifiers
 - D. Distortion is very high in case of class-C amplifiers

Ans. C

Sol. Class-C amplifier is heavily biased so that the output current is zero for more than one half of the input cycle. It means the conduction angle is less than 180° .

Also, class C amplifier has very poor linearity as compared to other classes of power amplifiers.

Distortion is very high in case of class-C amplifiers, so, they are not suitable for use as audio amplifiers. These amplifiers are commonly used in high frequency sine wave oscillators and certain types of radio frequency amplifiers.

16. A clamper circuit

1) Adds or subtracts a dc voltage to or from a waveform

2) Does not change the shape of the waveform

Which of the above statements are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Ans. C

Sol. A clamper circuit can add or subtract the DC voltage to or from a waveform. The frequency of the waveform remains unaffected. Moreover, the shape remains unaltered with the addition of DC-voltage. Hence, the shape of the waveform remains the same before and after clamping.

17. If pu Resistance & Reactance of 1- ϕ transformer are 0.02, 0.04 then its voltage regulation at pf 0.6 lagging will be –

A. 3.5 %

B. 2.4 %

C. 4.4 %

D. 5.8 %

Ans. C

Sol. Given:

$$R_{pu} = 0.02, X_{pu} = 0.04$$

Power factor = 0.6 lagging

Voltage regulation

$$V.R. = (R_{pu} \cos\phi + X_{pu} \sin\phi) \times 100\%$$

$$= (0.02 \times 0.6 + 0.04 \times 0.8) \times 100\% = 4.4\%$$

18. In underground cables, to prevent the entry of moisture into the outside surface of insulation, which of the following is used?

A. Serving

B. Armouring

C. Bedding

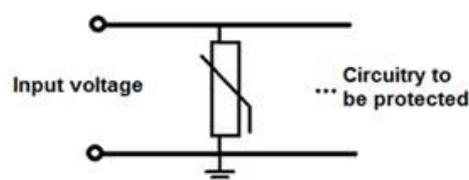
D. Metallic sheath

Ans. D

Sol. Metallic sheath prevents moisture from entering dielectric, so that dielectric strength is maintained.

Therefore, Option D is correct.

19. The purpose of Surge Arrester is to:



- A. limit surge voltages on equipments
- B. install the transmission lines
- C. restrict the flow of extra current
- D. safe guard line inductance

Ans. A

Sol. Surge Arrester is a protecting device which limits surge voltages on equipment by diverting surge current and bringing the device to original status.

20. Which type of earthing is also called as 'fire earthing'?

- I. Plate earthing
- II. Rod earthing
- III. Strip earthing

- A. Only I
- B. only II
- C. Only III
- D. I, II and III

Ans. B

Sol. Generally Earthing are used for safety of human beings. The earthing are always treated with the ingredients such as Charcoal, sand & salt. Which in turn absorbs moisture and that decreases the resistance of soil.

Rod Earthing:

1) The Rod earthing is basically non - treatment earthing. A copper rod of 12.5mm (1/2 inch) diameter or 16mm (0.6in) diameter of galvanized steel or hollow section 25mm (1inch) of GI pipe of length above 2.5m (8.2 ft) are buried upright in the earth manually or with the help of a pneumatic hammer. The length of embedded electrodes in the soil reduces earth resistance to a desired value.

2) Rod Earthing is also called as fire earthing

21. Which of the following statement are correct for Hysteresis motor?

- 1) At synchronous speed eddy current torque is zero.
- 2) rotor is a smooth solid cylinder of hard steal
- 3) Hysteresis torque is constant at all speeds.

- A. 1, 2
- B. 2, 3
- C. 1, 3
- D. 1, 2, 3

Ans. D

Sol. Eddy current losses $P_e \propto f_2^2 B_m^2 \propto s^2 f^2 B_m^2$

$$\text{Air gap power } P_g = \frac{P_e}{s}$$

$$\text{Torque } T = \frac{P_g}{\omega} \propto \frac{s^2 f^2 B_m^2}{s\omega}$$

$$T \propto \frac{s f^2 B_m^2}{\omega}$$

At synchronous speed $s = 0$

Sol.

$$\text{Load factor} = \frac{\text{Avg. load}}{\text{Max. load}}$$

$$\text{Average load} = \frac{50 \times 6 + 80 \times 4 + 30 \times 10 + 40 \times 4}{24} = 45 \text{ MW}$$

$$\text{Load factor} = \frac{45}{80} = 0.5625$$

$$\text{Demand factor} = \frac{\text{Max. Demand}}{\text{Connected load}}$$

$$= \frac{80}{100} = 0.8$$

25. Consider the following statements: Characteristics of a good insulating material are

- 1) Should give uniform electric and thermal properties.
- 2) High permittivity.
- 3) Low dissipation factor.
- 4) Low insulating resistance.

Which of the above statements are correct?

- | | |
|-----------------|------------------|
| A. 1 and 4 only | B. 2 and 4 only |
| C. 1 and 3 only | D. 1, 2, 3 and 4 |

Ans. C

Sol. Good insulating materials possess high insulating resistance. So, (c) is correct.

26. A 230 V, 100 A energy meter on full load makes 72 revolutions in 36 sec. if the meter constant is 600 rev/kWh what is the percentage error.

- | | |
|-----------|-----------|
| A. -28.8% | B. -47.8% |
| C. -41.5% | D. -25.7% |

Ans. B

Sol. \Rightarrow measured no. of revolution is = 72

$$\Rightarrow \text{true value of revolution} = \frac{230 \times 100 \times 36}{1000 \times 60 \times 60} \times 600 = 138$$

$$\Rightarrow \text{error} = \left(\frac{\text{measured value} - \text{True Value}}{\text{True Value}} \right) = \left(\frac{72 - 138}{138} \right) \times 100 = -47.8\%$$

27. The leakage current in a semiconductor diode is:

1. Due to minority carriers.
2. Due to majority carriers.
3. Less in silicon diodes as compare to germanium diode.
4. Less in germanium diode as compare to silicon diode.

The correct statement are:

- | | |
|------------|------------|
| A. 1 and 3 | B. 1 and 4 |
| C. 2 and 3 | D. 2 and 4 |

Ans. A

Sol. Laws of Illumination states that Inverse Square Law Intensity is inversely proportional to the square of the distance from the source. $E = I / r^2$

31. What is the unit of luminous intensity?

- | | |
|---------------------------|-------------------------|
| A. candela | B. lumen/m ² |
| C. candela/m ² | D. lumen |

Ans. A

Sol. **Luminous Intensity:** Intensity in a given direction, the luminous flux emitted by the source per unit solid angle.

$$I = F/\omega, \text{ Unit- Candela or Lumen/ Steradian}$$

32. Swinburne's Test is related to

- | | |
|------------------------|----------------------|
| A. Transformer | B. Induction Machine |
| C. Synchronous Machine | D. DC Machine |

Ans. D

Sol. Swinburne's test is the most commonly used and simplest method of testing of shunt and compound wound DC machines which have constant flux. In this test the efficiency of the machine at any load is pre-determined. We can run the machine as a motor or as a generator.

33. A 10 pole, 25 Hz alternator is directly driven by a 60 Hz synchronous motor. Then the number of poles in the synchronous motor are

- | | |
|-------|-------|
| A. 48 | B. 12 |
| C. 24 | D. 10 |

Ans. C

Sol. Let the synchronous speed of the motor be N_{sm}

We know that,

$$N_{sm} = \frac{120 \times f_m}{P_m}$$

Where, f_m = frequency of the motor

P_m = Number of poles of motor

Therefore,

$$N_{sm} = \frac{120 \times 60}{P_m}$$

Synchronous speed of the generator (or alternator) is

$$N_{sg} = \frac{120 \times f_g}{P_g} = \frac{120 \times 25}{10} = 300 \text{ rpm}$$

Since, the alternator and synchronous motor are directly connected or coupled, then

$$N_{sg} = N_{sm}$$

$$300 = \frac{120 \times 60}{P_m}$$

$$P_m = \frac{120 \times 60}{300}$$

$$P_m = 24$$

Therefore, the number of poles of synchronous motor is 24.

34. An aquadag is used in a CRO to collect
- A. Primary electrons only
 - B. Secondary emission electrons only
 - C. Both primary electrons and secondary emission electrons
 - D. Heat emission electrons

Ans. B

Sol. Boundary of CRT screen is coated by aquadag coating to protect CRT from secondary emission electrons.

35. When light is produced by fittings that throw all the light on the ceiling, from where it is reflected to the area to be lighted, this method of lighting arrangement is known as:
- A. general diffusing system
 - B. semi-direct system
 - C. indirect lighting arrangement
 - D. direct lighting arrangement

Ans. C

Sol. In indirect lighting ϕ scheme light is not incident directly on object.

36. In case of Hunting, when there is super synchronous speed, Damper Bar develops
- A. Reactance torque
 - B. Induction motor torque
 - C. Eddy current torque
 - D. Induction generator torque

Ans. D

Sol. In case of rotor speed larger than synchronous speed, induction generator torque is developed in the opposite direction of rotor rotation. In this case rotor decelerate to reach synchronous speed.

37. Which of the following properties is correct about servomotor.
- A. High inertia and high starting torque
 - B. low inertia and low starting torque
 - C. low inertia and high string torque
 - D. High inertia and low starting torque

Ans. C

Sol. Properties of servomotors

- ⇒ Low inertia and high starting torque
- ⇒ Due to low-inertia they are able to reverse direction quickly
- ⇒ They are able to accelerate and de-accelerate quickly.
- ⇒ They are able to return to a given position time after time without and drift.

38. For an overhead line surge impedance is 400Ω which is extended by cable having surge impedance of 200Ω . If 1 pu of surge wave released onto overhead line reached to junction of line and cable. Then reflection coefficient of current is_____
- A. 0.33
 - B. -0.33
 - C. 1.33
 - D. -01.33

Ans. B

Sol. We know that force on conductor $\vec{F} = q(\vec{v} \times \vec{B})$

$$\text{Dimension of } B = \frac{\text{dimension of } F}{\text{dimension of } v \times \text{dimension of } Q} = \frac{MLT^{-2}}{LT^{-1} \times Q} = MT^{-1}Q^{-1}$$

46. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I:

- A. Improve power factor
- B. Reduce the current ripples
- C. Increase the power flow in line
- D. Reduce the Ferranti effect

List-II:

- 1. Shunt reactor
- 2. Shunt capacitor
- 3. Series capacitor
- 4. Series reactor

The correct order of sequence of List-I (A B C D) is

- A. 2 3 4 1
- B. 2 4 3 1
- C. 4 3 1 2
- D. 4 1 3 2

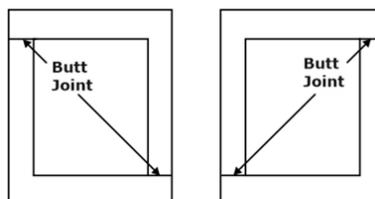
Ans. B

Sol. 1) Shunt capacitor at the load increases the power factor.
 2) Series reactor reduces the current ripples.
 3) Series capacitor increase the power flow in the line.
 4) Shunt reactor reduces the Ferranti effect.

47. In a core-type single-phase transformer the steel-core is assembled by staggering butt-joint in adjacent layers of laminations vide figures. The purpose served is said to be

- 1) Avoiding continuous air-gap
- 2) Preventing loss of mechanical strength
- 3) Reducing eddy-current loss

Which of the above statement are true?



- A. 1 and 2 only
- B. 1 and 3 only
- C. 2 and 3 only
- D. 1, 2 and 3

Ans. A

Sol. The staggering of butt joints avoids continuous air gap as the flux can take path from neighbouring layer at the joints

At the same time staggering maintains mechanical strength of the core. Air gap also avoids magnetic saturation of the core.

Staggering of butt joints does not affect eddy currents. Eddy currents are reduced by laminations. Hence correct option is (A)

48. The losses in electric drive systems is/are

- A. Electrical Transmission Losses
- B. Mechanical Transmission Losses
- C. Load Losses
- D. All of the above

Ans. D

Sol. LOSSES IN AN ELECTRICAL DRIVE SYSTEM

Energy conservation in an electrical drive is achieved by the reduction of losses in its various parts. Typical losses include the following:

- Electrical transmission losses: These losses depend on the drive power factor and harmonics in the line current.
- Conversion losses in the power modulator (or converter): The semiconductor converter usually has low conversion losses.
- Electric motor losses to convert electric power into mechanical power: These are determined by choice of the motor (quality of its design and selection of right rating) and quality of supply (voltage variations, unbalance, frequency variations and harmonics).
- Mechanical losses:- It is part of the transmission system such as bearings, gears, clutches, and belts.
- Losses in the load: A load in a machine required to perform a specified task such as fan, pump, and train.

49. When the current through the coil of an electromagnet reverses, the:

- A. magnetic field collapses
- B. direction of the magnetic field reverses
- C. direction of the magnetic field remains unchanged
- D. magnetic field expands

Ans. B

Sol. When you change the direction of current, the curl magnetic field will just reverse the direction. If with the former current direction the magnetic field were clockwise, now on reversing the direction, the magnetic field will be counter clockwise.

50. At resonant frequency, the impedance of a series resonant circuit is _____.

- A. Zero
- B. Maximum
- C. Infinite
- D. Minimum

Ans. D

Sol. At resonance the impedance of the series circuit is at its minimum value and equal only to the resistance of the circuit.

51. Oxy-acetylene welding is categorised in

- A. Arc welding
- B. Gas welding
- C. Chemical welding
- D. Resistance welding

Ans. B

Sol. Oxy acetylene Welding is categorized as gas welding.

52. Nichrome is an alloy of

- A. Manganese 2.5%, Nickel 81% to 84%, Chromium 14% to 17% and a little percentage of Iron.
- B. Manganese 2.0%, Nickel 78% to 81%, Chromium 17% to 20% and a little percentage of Iron.
- C. Manganese 1.5%, Nickel 75% to 78%, Chromium 20% to 23% and a little percentage of Iron.
- D. Manganese 0.5%, Nickel 72% to 75%, Chromium 23% to 26% and a little percentage of Iron.

Ans. B

Sol. "Nichrome as the name suggests is an alloy of nickel and chromium. It is known for its high resistance to heat and electricity. It is most desired for its property of high resistance to corrosion and high melting point. It is generally composed of 80% nickel and 20% chromium, but sometimes has some amount of Manganese mixed with it.

53. A current of $6 + 8\sqrt{2}\sin(\omega t + 30^\circ)$ A is measured by PMMC & MI instrument then what will the reading of instrument respectively?

- A. 10A, 6A
- B. 6A, 10A
- C. 8A, 10A
- D. 10A, 8A

Ans. B

Sol. Since PMMC instrument measure only DC or average value

Thus, Average value of $i(t) = 6A$

\Rightarrow Moving iron measure rms value

$$\text{So, } i(t)_{\text{rms}} = \sqrt{(6)^2 + \left(\frac{8\sqrt{2}}{\sqrt{2}}\right)^2} = 10A$$

54. Which of the following is true about the Optical Ground Wire?

- A. provides reliable fiber optic communication.
- B. high fiber count
- C. cheaper than ADSS cable
- D. placed with electrical transmission lines

Ans. A

Sol. Optical Ground Wire is composite wire that works as conventional overhead ground wire which gives high capacity and reliable fiber optic communication.

55. Stud and projection welding belong to the following category of welding _____.
- A. gas welding
 - B. arc welding
 - C. resistance welding
 - D. pressure welding

Ans. C

Sol. Stud welding, also known as "drawn arc stud welding", joins a stud and another piece of metal together by heating both parts with an arc. The stud is usually joined to a flat plate by using the stud as one of the electrodes. The polarity used in stud welding depends on the type of metal being used. Welding aluminum, for example, would usually require direct-current electrode positive (DCEP). Welding steel would require direct-current electrode negative (DCEN).

56. Match List-I (Instrument) with List-II (Characteristics/Classification) and select the correct answer using the codes given below the lists:

List-I:

- A. Watt hour meter
- B. Ohmmeter
- C. Moving Iron type
- D. Thermocouple type

List-II:

- 1. Indicating type instrument
- 2. Reads rms value using square law scale
- 3. True rms upto RF range
- 4. Integrating balance

The correct sequence of the List-I (A B C D) is

- A. 1 4 3 2
- B. 1 2 3 4
- C. 4 3 2 1
- D. 4 1 2 3

Ans. D

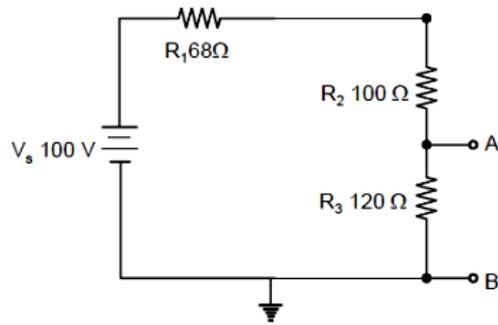
Sol. Watt hour meter → Integrating balance
Ohmmeter → Indicating type instrument
Moving iron type → Reads rms value using square law scale
Thermocouple type → True rms upto RF range

57. The luminous efficiency of a sodium vapour-discharge lamp is in the range of ?
- A. 10 – 12 lumens/watt
 - B. 25 – 30 lumens/watt
 - C. 45 – 50 lumens/watt
 - D. 70 – 90 lumens/watt

Ans. C

Sol. The efficiency of sodium vapour lamp is lies between 40 - 50 lumens/watt and average life is about 3000 Hr.

58. What are the Thevenin's equivalent voltage V_{TH} and resistance R_{TH} between the terminals A and B of the circuit?

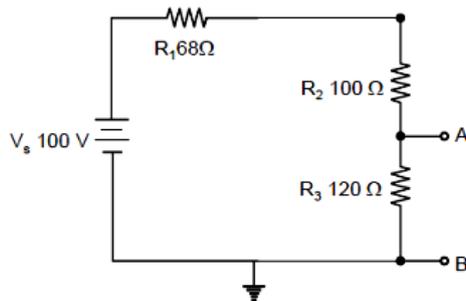


- A. 4.16 V and 120Ω
- C. 4.16 V and 70 Ω

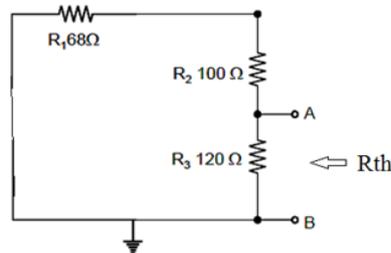
- B. 41.67 V and 120Ω
- D. 41.67 V and 70Ω

Ans. D

Sol.

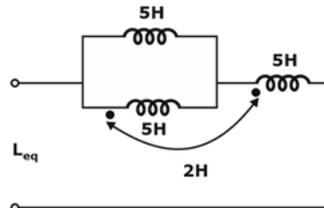


$$V_{th} \text{ (voltage across AB)} = [120 / (120+100+68)] \times 100 = 41.67 \text{ V}$$



$$R_{th} = (68+100) || 120 = (168 \times 120) / (168 + 120) = 70 \text{ ohm}$$

59. What is the equivalent inductance of the below circuit ?

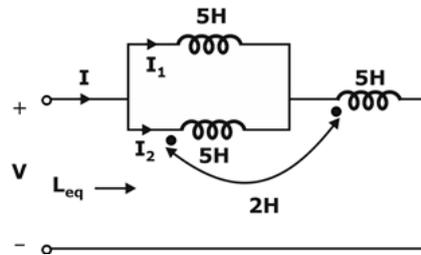


- A. 8 H
- C. 9.1 H

- B. 2.5 H
- D. 10.1 H

Ans. C

Sol.



Apply KVL

$$V = 5 \frac{dI_2}{dt} + 2 \frac{dI}{dt} + 5 \frac{dI}{dt} + 2 \frac{dI_2}{dt}$$

$$V = 7 \frac{dI_2}{dt} + 7 \frac{dI}{dt} \quad \dots \text{equation(1)}$$

Also,

$$V = 5 \frac{dI_1}{dt} + 5 \frac{dI}{dt} + 2 \frac{dI_2}{dt} \quad \dots \text{equation(2)}$$

$$\text{and } I = I_1 + I_2$$

$$\frac{dI}{dt} = \frac{dI_1}{dt} + \frac{dI_2}{dt}$$

$$\frac{dI_1}{dt} = \frac{dI}{dt} - \frac{dI_2}{dt} \quad \text{put in eq. (2)}$$

$$V = 10 \frac{dI}{dt} - 3 \frac{dI_2}{dt} \quad \dots (3)$$

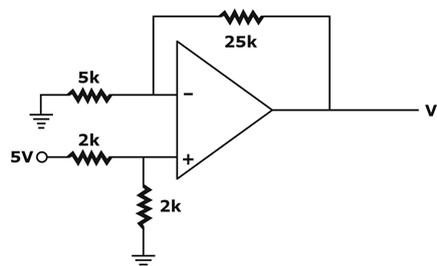
subtract (1) from (3)

$$0 = 3 \frac{dI}{dt} - 10 \frac{dI_2}{dt} \Rightarrow \frac{dI_2}{dt} = \frac{3}{10} \frac{dI}{dt} \quad \text{put in eq. (1)}$$

$$V = \left(\frac{21}{10} + 7 \right) \frac{dI}{dt}$$

$$L_{eq} = \frac{91}{10} = 9.1H$$

60. The output voltage of the op-amp circuit is



A. 20 V

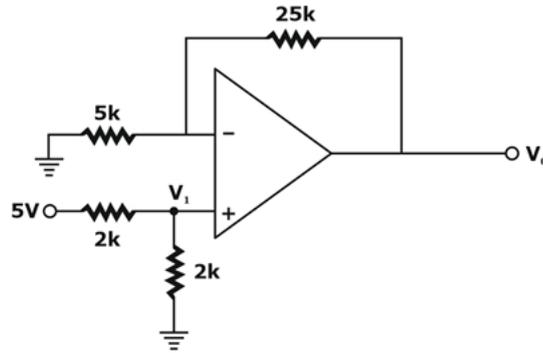
B. 15 V

C. 30 V

D. 12 V

Ans. B

Sol.



$$\Rightarrow V_1 = \left[\frac{5 \times 2}{2 + 2} \right] = \left(\frac{10}{4} \right) = 2.5 \text{ V}$$

$$\Rightarrow V_0 = V_1 \left(1 + \frac{25}{5} \right) = 6V_1$$

$$V_0 = 6V_1 = 6 \times 2.5 = 15.0 \text{ V}$$

61. In flux meter instrument the damping provided is –

- A. Air friction
- B. eddy current
- C. Electromagnet damping
- D. Fluid friction damping

Ans. C

Sol.

Instruments	Type of Damping
Moving Iron, EDM	Air friction damping
Electrostatic instruments	Fluid Damping
PMMC, induction type	Eddy current Damping
Flux meter	Electromagnet Damping

62. For a BJT, ratio I_C/I_E is 0.5, then ratio of I_C/I_B will be:

- A. 1
- B. 2
- C. 25
- D. 100

Ans. A

Sol.

$$\frac{I_C}{I_E} = \alpha \text{ and } \frac{I_C}{I_B} = \beta$$

$$\text{Since } \beta = \frac{\alpha}{1 - \alpha}$$

$$\text{and } \alpha = 0.5 \text{ so}$$

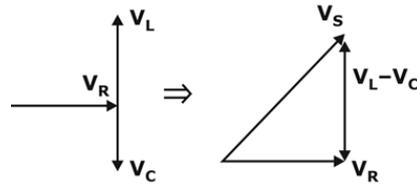
$$\beta = \frac{0.5}{1 - 0.5} = 1$$

63. In a certain series circuit, $V_C = 120 \text{ V}$, $V_L = 150 \text{ V}$ and $V_R = 40 \text{ V}$, then the source voltage is

- A. 50 V
- B. 60 V
- C. 100 V
- D. 200 V

Ans. A

Sol. Phasor diagram of series circuit is shown below,



$$\text{Source voltage } V_s = \sqrt{(V_R)^2 + (V_L - V_C)^2}$$

$$\text{Given, } V_R = 40 \text{ V, } V_L = 150 \text{ V, } V_C = 120 \text{ V}$$

$$\therefore V_s = \sqrt{(40)^2 + (30)^2} = 50 \text{ V}$$

64. Hand tool application uses which of the following motors?

- A. AC series motor
- B. Shaded pole motor
- C. Resistance motor
- D. None of the above

Ans. A

Sol. For hand tool applications, AC series motor is used.

So, Option (A) is correct.

65. In a circuit, voltage across an element is $V(t) = 45 \sin(2t + 60^\circ)$ and current through the element is $i(t) = 15 \sin(2t - 30^\circ)$. Determine the circuit element and its value.

- A. Inductor, $L = 2.5 \text{ H}$
- B. Capacitor, $C = 1/6 \text{ F}$
- C. Capacitor, $C = 2/6 \text{ F}$
- D. Inductor, $L = 1.5 \text{ H}$

Ans. D

Sol. Current $i(t)$ lags $V(t)$ by 90° .

\therefore Element is a pure inductor.

$$\text{Impedance, } Z = \frac{V_{\text{rms}}}{I_{\text{rms}}} = \frac{\frac{45}{\sqrt{2}}}{\frac{15}{\sqrt{2}}} = 3 \Omega$$

$$Z = X_L = \omega L$$

$$\omega = 2 \text{ rad/s}$$

$$\therefore 2L = 3$$

$$L = 1.5 \text{ H}$$

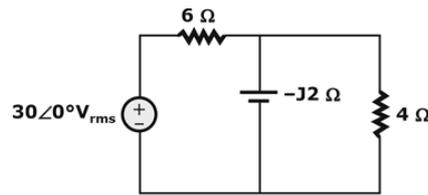
66. For a short line fault without switching resistor the most suitable circuit breaker is

- A. Minimum oil Circuit Breaker
- B. SF_6 Circuit Breaker
- C. Air blast Circuit Breaker
- D. None of the above

Ans. B

Sol. In SF_6 circuit breaker, the SF_6 gas is used at low velocity and low pressure due to which current chopping is prevented and capacitive currents are interrupted without restriking. Due to these reasons no switching resistor is required in this circuit breaker. Hence it is most suitable for short line fault without switching resistor.

67. Determine the power factor of the entire circuit of fig as seen by the source. Calculate the average power delivered by the source.



- A. 0.973 leading and 125 W B. 0.876 leading and 100 W
C. 0.546 leading and 125 W D. 0.345 leading and 100 W

Ans. A

Sol. The total impedance is, $z = 6 + 4 \parallel (-j2) = 6 + \frac{-j2 \times 4}{4 - j2} = 6.8 - j1.6 = 7 \angle -16.24^\circ \Omega$

The power factor is, $p_f = \cos(-13.24) = 0.9734(\text{leading})$

Since the impedance is capacitive. The rms value of the current is,

$$I_{\text{rms}} = \frac{V_{\text{rms}}}{z} = \frac{30 \angle 0^\circ}{7 \angle -13.24^\circ} = 4.286 \angle 13.24^\circ \text{A}$$

The average power supplied by the source is,

$$P = V_{\text{rms}} I_{\text{rms}} p_f = (30)(4.286)(0.9734) = 125 \text{W}$$

$$\text{or } P = I_{\text{rms}}^2 R = (4.286)^2 (6.8) = 125 \text{W}$$

where R is the resistive part of Z.

68. 'Dead Zone' is defined as
- Initial warm up time of an instrument
 - largest change in Input quantity, for which there is no instrument output
 - Respond time of an instrument
 - Unmeasured instrument reading beyond instrument maximum range

Ans. B

Sol. Dead zone is defined as the largest change in the physical variable to which instrument does not respond.

69. In which of the following winding we don't use equaliser ring?
- Simplex lap winding
 - Duplex lap winding
 - Simplex wave winding
 - Duplex wave winding

Ans. C

Sol. For simplex lap winding no. of parallel path, $A = P$

For duplex lap winding no. of parallel path, $A = 2P$

For simplex wave winding no. of parallel path, $A = 2$

For duplex wave winding no. of parallel path, $A = 4$

Since simplex wave winding has only 2 parallel paths so in this winding, we don't need to provide equaliser ring

70. In a DC machine, armature MMF is
- A. Stationary in space
 - B. Having triangular space distribution
 - C. Both (a) and (b)
 - D. Neither (a) Nor (b)

Ans. C

Sol. In a DC machine, armature MMF is stationary in space and has triangular space distribution.

71. West Bengal shares boundaries with countries.
- A. 2
 - B. 4
 - C. 1
 - D. 3

Ans. D

Sol. • **West Bengal** is bordered by **three** countries named **Bangladesh, Nepal,** and **Bhutan.**

- **West Bengal** shares the border with the Indian states of **Odisha, Jharkhand, Bihar, Sikkim,** and **Assam.**
- **Arunachal Pradesh** shares the border with **Myanmar, China,** and **Bhutan.**
- **Sikkim** shares the border with **Bhutan, China,** and **Nepal.**

72. Coins of..... denomination were introduced by the Reserve Bank of India (RBI) to mark MG Ramachandran's 1 birth centenary.
- A. 200
 - B. 100
 - C. 500
 - D. 20

Ans. B

Sol. • Coins of 100 denomination were introduced by the Reserve Bank of India (RBI) to mark MG Ramachandran's 1 birth centenary.

- MG Ramachandran was awarded Bharat Ratna posthumously in 1988.
- The autobiography Naan Yaen Piranthen of MG Ramachandran was published in 2003.

73. The headquarters of CAPART is located in_____.
- A. Mumbai
 - B. New Delhi
 - C. Lucknow
 - D. Bhopal

Ans. B

Sol. * The Council for Advancement of People's Action and Rural Technology (CAPART) was launched in 1986.

- * It is an autonomous body registered under the Societies Registration Act 1860.
- * It is chaired by the **Union Minister for Rural Development.**
- * It is headquartered in **New Delhi.**
- * Its main objective is to encourage, promote and support voluntary action in the implementation of projects for the growth of rural prosperity.

74., the Sultan of Delhi shifted his capital from Delhi to Daulatabad.
- A. Iltutmish
 - B. Akbar
 - C. Ghiyas-ud-din Balban
 - D. Muhammad-bin-Tughlaq

Ans. D

Sol. • Muhammad-bin-Tughlaq is the Sultan of Delhi shifted his capital from Delhi to Daulatabad.

- He was sultan of delhi from 1325 to 1351.
- The founder of Tughlaq dynasty was Muhammad-bin-Tughlaq's father Ghiasuddin Tughlaq.

75. Which of the following country has the longest coastline in the world?

- A. Australia
- B. Norway
- C. Canada
- D. Indonesia

Ans. C

Sol. • **Canada has the longest coastline in the world.**

- It is the **second-largest country of the world** by total area.
- The **capital of Canada** is **Ottwa** and **Currency** is **Canadian Dollar**.
- **Gujarat** is the **largest mainland coastline** state in India.

76. The Black soil is also known as soil.

- A. Bhangar
- B. Humus
- C. Crystalline
- D. Regur

Ans. D

Sol. • The Black soil is also known as **Regur soil**.

- The black color of black soil is due to excess of iron.
- Apart from black soil, it is also called Shregun, Regur, Cotton soil, and Lava soil.
- It is rich in magnesium, lime and iron and organic matter.
- It is found abundantly in Maharashtra, Karnataka, Gujarat and Madhya Pradesh.

77. Which Vitamin helps in clotting of blood?

- A. Vitamin A
- B. Vitamin C
- C. Vitamin B
- D. Vitamin K
- E. None of the above/More than one of the above

Ans. D

Sol. Vitamin K helps to make various proteins that are needed for blood clotting and the building of bones. Prothrombin is a vitamin K-dependent protein directly involved with blood clotting. Osteocalcin is another protein that requires vitamin K to produce healthy bone tissue.

78. The process to separate impurities from water, butter from curd, small stones from wheat etc. is called

- A. Mixture
- B. separation
- C. Filtration
- D. Sublimation

Ans. B

Sol. Milk or curd is churned to separate the butter. Grain is separated from stalks, while harvesting. The process to separate impurities from water, butter from curd, small stones from wheat etc. is called separation.

Ans. B

Sol. * On the occasion of the National Youth Day 2022, the birth anniversary of Swami Vivekananda, Prime Minister (PM) Narendra Modi virtually inaugurated an 'MSME Technology Centre', which will function under the Union Ministry of Micro, Small and Medium Enterprises (MSME), in Puducherry.

* The centre was inaugurated during the inauguration event of the 25th National youth Festival (12th & 13th January 2022) in Puducherry.

* He also inaugurated the 'Perunthalaivar Kamarajar Manimandapam', a modern auditorium with an open-air theatre in Puducherry.

84. In collaboration with which of the following bodies has the NITI Aayog's Atal Innovation Mission (AIM) recently launched 'ATL Space Challenge 2021' ?

A. ISRO & DRDO

B. ISRO & CBSE

C. Hindustan Aeronautics Limited & CBSE

D. Hindustan Aeronautics Limited & ISRO

E. None of the above

Ans. B

Sol. * NITI Aayog's Atal Innovation Mission (AIM) has declared the results of 'ATL Space Challenge 2021', after successful completion and overwhelming participation from young innovators

* It was launched in collaboration with ISRO and CBSE

* The challenge was designed for all the school students, mentors and teachers across the country

* It witnessed over 2500 submissions from both ATL and Non-ATL students across the country from which 75 top innovators were selected and announced.

85. Which bank has been adjudged Best Private Bank in India at the Global Private Banking Awards 2021, organised by Professional Wealth Management (PWM)?

A. HDFC Bank

B. ICICI Bank

C. Yes Bank

D. Axis Bank

E. IndusInd Bank

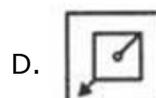
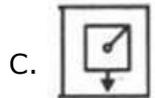
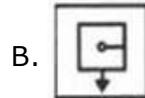
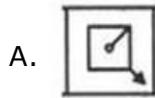
Ans. A

Sol. * HDFC Bank has been adjudged Best Private Bank in India at the Global Private Banking Awards 2021, organised by Professional Wealth Management (PWM).

* Professional Wealth Management (PWM) specialises in analysing the growth strategies of private banks and the regional financial centres in which they operate.

* The award was given for contributing to accelerate key trends, including digitalisation, communication and investment in environmental, social and governance (ESG) strategies.

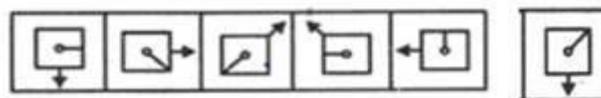
86. Select the figure that will come next in the following series.



Ans. C

Sol. The arrow is moving in 90 degrees and then 45 degrees alternatively in each step in the anticlockwise direction.

Also, the figure inside the square is also moving in 90 degrees and then 45 degrees alternatively in each step in the clockwise direction.



Hence, option C is the correct response.

87. In a certain language, 'roses are yellow' means 'mee muk pic', 'white flowers' means 'nil dic', and flowers are fruits' means 'pic muk dic'. What is the code for 'white' in that language?

- A. nil
- B. pic
- C. dic
- D. muk

Ans. A

Sol. 'roses are yellow' = 'mee muk pic' _____(1)

'white flowers' = 'nil dic' _____(2)

'flowers are fruits' = 'pic muk dic' _____(3)

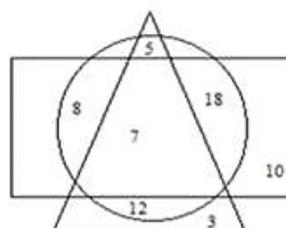
From (2) and (3), flowers=dic

Therefore, from (2), white=nil

Hence, option A is the correct answer.

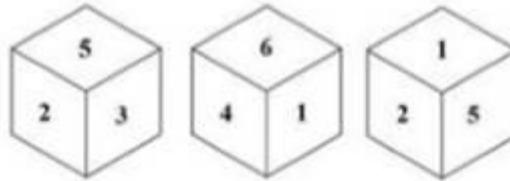
88. In the following diagram, the rectangle represents doctors, the triangle represents players and the circle represents philosophers.

The number in different segments show the number of persons.



Hence, option(B) is the correct response.

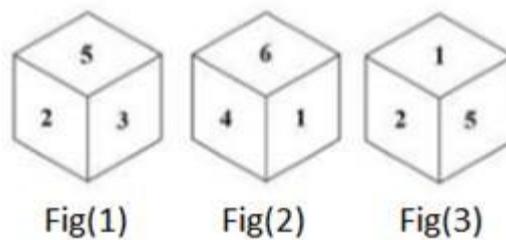
91. **Three different position of the same dice are shown below. Which number is on the face opposite the face showing "4"?**



- A. 5
 B. 3
 C. 2
 D. 6

Ans. A

Sol.



From fig(1) and fig(3), 2 and 5 are the consecutive side face of 3, also 2 and 5 are the consecutive side face of 1, therefore 3 is the opposite of 1.

From fig(2) and fig(3), 4, 6, 5, 2 are the consecutive side face of 1.

From 4, 6, 5, 2-

4 is opposite of 5 and 6 is opposite of 2.

Hence, the correct option is A.

92. **Two statements are given, followed by two conclusion I and II. Assuming these statements to be true, even if they seem to be at variance with commonly known facts, decide which of the given conclusion logically follow (s) from the statements.**

Statements:

All plants are flowers.

No flower is blue.

Conclusions:

I. Some plants are blue.

II. Those plants that are not flowers are blue.

- A. Only conclusion II follows.
 B. Only conclusion I follows.
 C. Both conclusion I and II follow.
 D. Neither conclusion I nor II follow.

Ans. D

Sol. The minimum possible diagram is-

94. Which of the following interchanges of signs and numbers would make the given equation current?

$$18 - 3 \div 6 + 24 \times 12 = 48$$

A. \times and $-$, 3 and 6

B. \div and $-$, 12 and 6

C. \div and \times , 3 and 12

D. \times and $+$, 3 and 6

Ans. A

Sol. By checking Option A,

$$18 - 3 \div 6 + 24 \times 12 = 48$$

After changing the symbols,

$$18 \times 6 \div 3 + 24 - 12 = 48$$

Applying BODMAS we get,

$$= 36 + 24 - 12$$

$$= 60 - 12$$

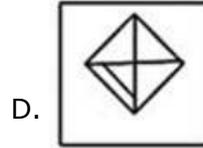
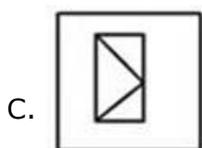
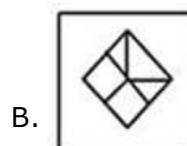
$$= 48$$

Therefore, $18 - 3 \div 6 + 24 \times 12 = 48$ is the correct equation.

As, we found the correct answer, so no need to check more options.

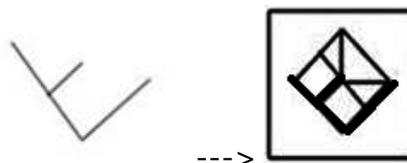
Hence, option A is the correct answer.

95. Select the option in which the given figure is embedded. (Rotation is not allowed)



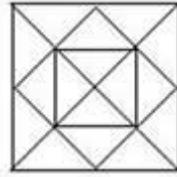
Ans. B

Sol. After carefully observing the figures given in the question, it is very clear that the question figure is embedded in the answer figure (D). It is shown as given below:



Hence, option B is the correct response.

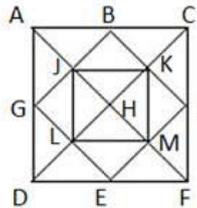
96. Find the number of squares in the following figure.



- A. 9
- B. 4
- C. 6
- D. 7

Ans. D

Sol.



There are 7 squares in the given figure; ACFD, BGEI, JKML, GJHL, BKHJ, HMIK, LHME. Hence, option D is correct.

97. Select the option that will come next in the given series.



- A.
- B.
- C.
- D.

Ans. A

Sol. After observation, it is clear that answer figure (a) will be the missing figure.

Logic- 3rd figure is the opposite figure of 1st similarly, 4th figure is the opposite figure of 2nd.



Hence, option (A) is the correct response.

98. **Two statements are given, followed by two conclusion I and II. Assuming these statements to be true, even if they seem to be at variance with commonly known**

facts, decide which of the given conclusion logically follow (s) from the statements.

Statements:

Some boxes are dolls.

All dolls are pen.

Conclusion:

I. Some boxes are pens.

II. Some pens are boxes.

III. Some pens are dolls.

IV. All pen are dolls.

A. Only conclusion II, III and IV follow.

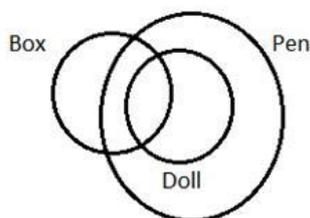
B. Only conclusion I, II and III follow.

C. Only conclusion I, II and IV follow.

D. All the conclusion follow.

Ans. B

Sol. Minimum possible diagram is-



Conclusion:

I. Some boxes are pens.(It follows as its obvious from the above diagram.)

II. Some pens are boxes.(It also follows as its obvious from the above diagram.)

III. Some pens are dolls. .(It also follows as its obvious from the above diagram.)

IV. All pen are dolls. .(It does not follow as its just a possibility, not surety.)

So, Only conclusion I, II and III follow.

Hence, option B is the correct answer.

99. **Select the correct alternative to indicate the arrangement of the following words in a logical and meaningful order.**

1) Gateway of India

2) World

3) Mumbai

4) India

5) Maharashtra

A. 2, 4, 5, 1, 3

B. 4, 2, 5, 3, 1

C. 2, 4, 5, 3, 1

D. 4, 2, 5, 1, 3

Ans. C

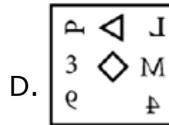
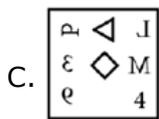
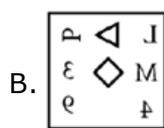
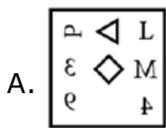
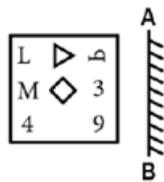
Sol. logical and meaningful order is,

- 2. World
- 4. India
- 5. Maharashtra
- 3. Mumbai
- 1. Gateway of India

Correct sequence = 2, 4, 5, 3, 1

Hence, option D is the correct answer.

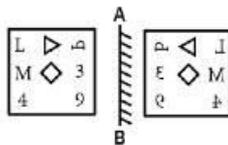
100. Select the correct mirror image of the given figure when the mirror is placed at line AB.



E. None of the above

Ans. B

Sol. In a plane mirror, a mirror image is a reflected duplication of an object that appears almost identical, but it is reversed in the direction perpendicular to the mirror surface. As an optical effect it results from reflection of substances such as a mirror or water.



Hence, option B is the correct answer.
