SSC Junior Engineer Online Exam

Electrical Engineering

SOLVED PAPERS
TECHNICAL
&
NON-TECHNICAL

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SSC Junior Engineer Paper Syllabus

ELECTRICAL ENGINEERING

The Examination will be conducted in two stages:
   A. Paper-I (Pre) (200 marks)
   B. Paper-II (Mains) (300 marks)
   Total Written Test (500 marks)
Written Test :

Paper	Subject	Max. Mark	Duration & Timing
Paper-I Objective type	(i) General Intelligence & Reasoning	50	2 Hours
	(ii) General Awareness	50	
	(iii) General Engineering (Electrical)	100	
Paper-II Objective type	General Engineering (Electrical)	300	2 Hours

There will be **negative marking equal to one-third (1/3) of the marks** allotted to the question for each wrong answer in Paper-I & negative marking of one mark for each wrong answer in Paper-II.

SSC JE Syllabus of Examination:

■ **Indicative Syllabus:** The standard of the questions in Engineering subjects will be approximately of the level of Diploma in Engineering (Civil/ Electrical/ Mechanical) from a recognized Institute, Board or University recognized by All India Board of Technical Education. All the questions will be set in SI units. The details of the syllabus are given below.

Paper-I

■ *General Intelligence & Reasoning:* The Syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

■ *General Awareness:* Questions will be aimed at testing the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighbouring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

■ **General Engineering Electrical**

Electrical Engineering

■ Basic concepts, Circuit law, Magnetic Circuit, AC Fundamentals, Measurement and Measuring instruments, Electrical Machines, Fractional Kilowatt Motors and single phase induction Motors, Synchronous Machines, Generation, Transmission and Distribution, Estimation and Costing, Utilization of Electrical Energy, Basic Electronics.

Detailed Syllabus (JE Electrical Engineering)

Basic concepts:

■ Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.

Circuit law :

■ Kirchhoff's law, Simple Circuit solution using network theorems.

Magnetic Circuit :

■ Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction.

AC Fundamentals :

■ Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phase system – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.

Measurement and measuring instruments :

■ Measurement of power (1-phase and 3-phase, both active and reactive) and energy, 2 wattmeter method of 3 phase power measurement. Measurement of frequency and phase angle. Ammeter and voltmeter (both moving coil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges. Use of CRO, Signal Generator, CT, PT and their uses. Earth Fault detection.

Electrical Machines :

■ D.C. Machine – Construction, Basic Principles of D.C. motors and generators, their characteristics, speed control and starting of D.C. Motors. Method of motor's braking, Losses and efficiency of D.C. Machines. (b) 1-phase and 3-phase transformers – Construction, Principles of operation, equivalent circuit, voltage regulation, O.C. and S.C. Tests, Losses and efficiency. Effect of voltage, frequency and wave form on losses. Parallel operation of 1 phase / 3-phase transformers. Auto transformers. (c) 3-phase induction motors, rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3-phase induction motors. Methods of braking, effect of voltage and frequency variation on torque-speed characteristics.

Fractional Kilowatt Motors and Single Phase Induction Motors : Characteristics and applications.

Synchronous Machines –

■ Generation of 3-phase e.m.f. armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power. Starting and applications of synchronous motors.

Generation, Transmission and Distribution –

■ Different types of power stations, Load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations. Power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults. Switchgears – rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Protection against earth leakage / over current, etc. Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars. Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system. Cable – different type of cables, cable rating and derating factor.

Estimation and costing :

■ Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices and IE Rules.

Utilization of Electrical Energy :

■ Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.

IMED

■ Entrepreneurship, Market Survey and Opportunity Identification, Project report Preparation, Introduction to Management, Leadership Motivation, Management Scope in Different Areas, Work Culture, Basic of Accounting Finance

Basic Electronics :

■ Working of various electronic devices e.g. P-N Junction diodes, Transistors (NPN and PNP type), BJT and JFET. Simple circuits using these devices.

Electrical SSC JE
Previous Online Papers Analysis Chart

Exam	Year	Total Question (Technical)	Total Question (Non-Technical)
SSC–JE	2023 (9 October Evening)	100	100
SSC–JE	2023 (10 October Evening)	100	100
SSC–JE	2023 (11 October Evening)	100	100
SSC–JE	2022 (14 November Evening)	100	100
SSC–JE	2022 (15 November Evening)	100	100
SSC–JE	2022 (16 November Evening)	100	100
SSC–JE	2021 (24 March Morning)	100	100
SSC–JE	2021 (24 March Evening)	100	100
SSC–JE	2020 (10 December Evening)	100	100
SSC–JE	2020 (29 October Evening)	100	100
SSC–JE	2020 (28 October Morning)	100	100
SSC–JE	2019 (26 September Morning)	100	100
SSC–JE	2019 (26 September Evening)	100	100
SSC–JE	2018 (22 January Morning)	100	100
SSC–JE	2018 (22 January Evening)	100	100
SSC–JE	2018 (23 January Morning)	100	100
SSC–JE	2018 (23 January Evening)	100	100
SSC–JE	2018 (24 January Morning)	100	100
SSC–JE	2018 (24 January Evening)	100	100
SSC–JE	2018 (25 January Morning)	100	100
SSC–JE	2018 (25 January Evening)	100	100
SSC–JE	2018 (27 January Morning)	100	100
SSC–JE	2018 (27 January Evening)	100	100
SSC–JE	2018 (29 January Morning)	100	100
SSC–JE	2018 (29 January Evening)	100	100
	Total	**2500**	**2500**

SSC JE Electrical Online Exam Topicwise Analysis Chart (2018-2023)

YEAR	SSC JE 22 Jan. 2018 (M)	SSC JE 22 Jan. 2018 (E)	SSC JE 23 Jan. 2018 (M)	SSC JE 23 Jan. 2018 (E)	SSC JE 24 Jan. 2018 (M)	SSC JE 24 Jan. 2018 (E)	SSC JE 25 Jan. 2018 (M)	SSC JE 25 Jan. 2018 (E)	SSC JE 27 Jan. 2018 (M)	SSC JE 27 Jan. 2018 (E)	SSC JE 29 Jan. 2018 (M)	SSC JE 29 Jan. 2018 (E)	SSC JE 26 Sep. 2019 (M)	SSC JE 26 Sep. 2019 (E)	SSC JE 10 Dec. 2020 (E)	SSC JE 29 Oct. 2020 (E)	SSC JE 28 Oct. 2020 (M)	SSC JE 24 March 2021 (M)	SSC JE 24 March 2021 (E)	SSC JE 14 November 2022 (E)	SSC JE 15 November 2022 (E)	SSC JE 16 November 2022 (E)	SSC JE 9 October 2023 (M)	SSC JE 10 October 2023 (E)	SSC JE 11 October 2023 (M)
BEE	43	44	43	44	45	44	45	45	44	44	45	44	34	25	31	32	30	27	30	33	31	36	33	29	32
Machine -I	12	12	12	13	13	13	14	11	9	13	11	13	7	12	18	16	13	12	15	12	11	11	15	14	14
Machine -II	8	8	7	8	7	8	7	7	5	6	6	6	17	9	9	12	12	14	15	8	10	8	11	14	12
Td.	7	7	6	7	6	6	7	8	6	8	8	7	7	13	7	8	9	6	7	9	8	9	11	9	6
EIM	8	8	9	8	8	7	12	8	7	3	11	9	7	5	8	4	7	7	7	6	10	7	7	13	7
SGP	4	4	4	4	3	3	2	3	2	1	0	3	1	1	0	0	2	2	2	0	0	1	0	0	1
PP	0	0	2	2	3	3	0	0	4	8	2	0	9	7	8	3	5	8	7	3	4	3	7	6	4
UEE	8	8	7	3	7	4	6	9	9	6	7	8	8	11	10	13	10	8	4	12	10	12	3	5	9
Electronics-I	5	3	4	5	5	5	5	4	5	5	3	4	5	10	3	5	5	4	6	9	6	7	7	6	9
Electronics-II	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	2	0	0	0	0	0	0	0
IEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
EEEM	2	2	3	3	3	4	2	3	5	3	4	3	2	3	3	2	3	2	2	0	2	0	2	0	2
EDDE	3	3	3	3	0	3	0	2	4	3	3	3	2	4	2	2	4	8	5	2	4	3	2	0	0
IMED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	3	2	4
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

BEE - Basic Electrical Engineering, **Machine-I -** Electrical Machine-I, **Machine -II-** Electrical Machine-II, **Td. -** Transmission and Distribution of Electrical Power,

EIM - Introduction to Electrical Measuring Instruments , **ESGP -** Electrical Switch Gear and Protection , **PP -** Power Plant, **UT -** Utilization of Electrical Energy ,

IEC - Industrial Electronics and Control, **EEEM -** Electrical and Electronic Engineering Material, **EDDE –** Electrical Design Drawing and Estimating

IMED - Industrial Management and Entrepreneurship Development.

SSC Junior Engineer Electrical Online Exam 2018
CPWD/CWC/MES
Electrical Engineering

Time : 10·15 am] [Exam Date : 22 January, 2018]

Technical : Electrical

1. Which of the following is the dimensional formula of conductance?
(a) $M^1L^2T^{-3}I^{-1}$
(b) $M^1L^{-2}T^{-3}I^{-2}$
(c) $M^{-1}L^{-2}T^3I^2$
(d) $M^1L^1T^{-3}I^1$

Ans : (c) Dimension of conductance is $M^{-1}L^{-2}T^3I^2$

$$\text{Conductance} = \frac{1}{R}$$

$$= \frac{1}{\dfrac{V}{I}} \qquad [\because V = IR]$$

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

$$= \frac{I}{\dfrac{W}{q}} \qquad \left[\because V = \frac{W}{q}\right]$$

$$= \frac{I.q}{W}$$

$$= \frac{I^2t}{W} \qquad [\because q = it]$$

$$= \frac{I^2T}{ML^2T^{-2}}$$

So, dimension of conductance $= \left[M^{-1}L^{-2}T^3I^2\right]$

2. Which one of the following statement is TRUE about the resistance of a conductor?
(a) The resistance of a conductor is inversely proportional to the length of the conductor.
(b) The resistance of a conductor is directly proportional to the area of the conductor
(c) The resistance of a conductor is inversely proportional to the pressure applied on the conductor.
(d) The resistance of a conductor is inversely proportional to the area of the conductor.

Ans : (d) Resistance of conductor is inversely proportional to the area of conductor and is directly proportional to length. So resistance of conductor,

$$R \propto \ell$$
$$R \propto \frac{1}{a}$$
$$R = \frac{\rho l}{a}$$

where, ρ = Specific resistance
l = length of wire
a = cross-sectional area

3. In parallel combination of resistance, the voltage is............
(a) lower across largest resistance
(b) higher across largest resistance
(c) same across each resistance
(d) higher across smaller resistance

Ans : (c) Voltage across every resistance is same in parallel combination of resistance. Where as in series combination the current flowing through each resistance is same.

4. Electrical conductivity of a conductor is measured in............
(a) Siemens
(b) Ohms
(c) Siemens/meter
(d) Ohms/meter

Ans : (c) Electrical conductivity of a conductor is measured in Siemens/meter. Conductivity is reciprocal of resistivity is electrical circuit.

Conductivity $\boxed{\sigma = \dfrac{1}{\rho}}$

We know that, $\boxed{G = \dfrac{1}{R}}$ and $\boxed{R = \rho\dfrac{\ell}{a}}$

$$G = \frac{1}{\dfrac{\rho\ell}{a}} = \frac{a}{\rho\ell} = \frac{1}{\rho}\left(\frac{a}{\ell}\right)$$

$$G = \sigma\left(\frac{a}{\ell}\right), \qquad \sigma = \frac{G \times \ell}{a}$$

we know that SI unit of conductance is mho or Siemen,

So, that $\sigma = \dfrac{\text{Siemen} - m}{m^2}$

$$\boxed{\sigma = \frac{\text{Siemen}}{m} \text{ or} \left(\text{siemen meter}^{-1}\right) \text{or} \left(\text{sm}^{-1}\right)}$$

5. What will be the equivalent capacitance of a parallel combination of four capacitors having equal value of capacitance 'C'?
(a) C/4
(b) 4C
(c) C/2
(d) 2C

Ans : (b) Equivalent capacitance of a parallel combination of four capacitors is equal to algebraic sum of every capacitor.

$$C_{eq} = C_1 + C_2 + C_3 + C_4 \, ... \, C_n$$
$$C_{eq} = C + C + C + C$$

$$\boxed{C_{eq} = 4C}$$

6. What will be the potential difference (in V) between the ends of a conductor when the current flowing through the conductor is 3 A and the value of conductance is 0.3 mho?
(a) 10   (b) 100
(c) 20   (d) 0.1

Ans : (a) Given that,
Current I = 3 Amp.
Conductance G = 0.3 mho

Resistance $R = \dfrac{1}{G}$

Potential Difference $V = IR = \dfrac{I}{G} = \dfrac{3}{0.3} = 10V$

7. Determine the value of charge stored (in mC) in a capacitor, when the value of capacitance is 0.01 mF and the potential difference between the ends of the capacitor is 20 V.
(a) 0.2   (b) 2
(c) 20   (d) 200

Ans : (a) Given that,
Capacitance C = 0.01 m farad = 0.01×10^{-3} farad
Potential difference V = 20V
Stored charge $Q = CV$,
$Q = 0.01 \times 10^{-3} \times 20$
$\boxed{Q = 0.2\,mC}$

8. Determine the value of current (in A) drawn from a 8V battery, when a wire of 24 ohms resistance is stretched double of its original length and then cut into two equal parts and these equal are connected in parallel with the battery?
(a) 0.33   (b) 0.65
(c) 0.24   (d) 0.47

Ans : (a) New resistance of stretched doubled wire,
$R' = n^2 R$
$R' = 2^2 \times 24$
$\boxed{R' = 96\Omega}$
Wire cuts in two equal parts and connected in parallel then, equivalent resistance,
$\dfrac{1}{R_{eq}} = \dfrac{1}{48} + \dfrac{1}{48} = \dfrac{48 \times 48}{48 + 48}$
$R_{eq} = 24\Omega$

Current, $I = \dfrac{V}{R} = \dfrac{8}{24}$ $\boxed{I = 0.33 A}$

9. Determine the heat (in joule) dissipated through a resistor of 15 ohm resistance, when 0.5 A of current is flowing through the resistor for 8 second.
(a) 40   (b) 30
(c) 20   (d) 60

Ans : (b) Given that, Current I = 0.5 Amp.
Time t = 8 sec
Resistance R = 15 Ω
Dissipated heat $H = I^2 Rt = 0.5 \times 0.5 \times 15 \times 8$
$H = 0.25 \times 120$
$H = 30$ Joule

10. What will be the colour-coding of a resistor when the resistance of the resistor is 15 ohms?
(a) Green-Brown-Black-Black
(b) Brown-Green-Brown-Brown
(c) Brown-Green-Black-Brown
(d) Brown-Green-Black-Black

Ans : (d)

Colour	Value (AB)	Multiplier (C)	Tolerance %
Black	0	10^0 (1)	0
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	–
Yellow	4	10^4	–
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Gray	8	10^8	–
White	9	10^9	–
Gold	–	10^{-1}	5
Silver	–	10^{-2}	10
None	–	–	20

$R = AB \times 10^C \pm Tolerance$
$R = 15 \times 10^0 + 0$
$R = 15\Omega$
So, 15Ω = Brown-Green- Black-Black .

11. Which one of the following statement is TRUE about the Kirchhoff's voltage law?
(a) The algebraic sum of all the voltage around any closed path is infinite.
(b) The algebraic sum of all the voltages around any closed path is negative.
(c) The algebraic sum of all the voltages around any closed path is one.
(d) The algebraic sum of all the voltages around any closed path is zero.

Ans : (d) In Kirchhoff's Voltage Law, Algebraic sum of all voltages are equal to zero in any closed loop. according to Kirchhoff's voltage law in any closed loop multiplication of flowing current and its all resistance is equal to algebraic sum of all e.m.f. in that loop. It is also based on energy conservation law.
$$\sum IR + \sum EMF = 0$$

12. Which one of the following is the CORRECT statement for superposition theorem?
(a) The algebraic sum of all the voltages around any closed path is zero.
(b) The overall current in any part of a linear circuit is equal to the algebraic sum of the currents produced by each source separately.
(c) The sum of currents entering a node is equal to the sum of currents leaving the node.
(d) The algebraic sum of all the voltages around any closed path is equal to one.

Ans : (b) According to superposition theorem, the overall current in any part of a linear circuit is equal to the algebraic sum of the currents produced by each source separately. It works only for linear element. Superposition theorem is not used for the calculation of power.

13. Which one of the expression satisfies the condition of maximum power transfer theorem?
(a) $Z_L = Z_S{}^*$ (b) $Z_L = R_L$
(c) $Z_L = 2Z_S$ (d) $X_L = R_L$

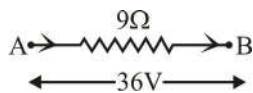**Ans : (a)** for maximum power transfer,
$$\boxed{Z_L = Z_S{}^*}$$
(i) If $Z_S = R_S + jX_S$ and $Z_L = R_L + jX_L$
then, $\boxed{R_L = R_S}$ and $\boxed{X_L = -X_S}$
(ii) If $Z_S = R_S + jX_S$ and $Z_L = R_L$
then, $\boxed{R_L = \sqrt{R_S{}^2 + X_S{}^2}}$
(iii) If $Z_L = R_L$ and $Z_S = R_S$
then $\boxed{R_L = R_S}$

14. Determine the value of current (in A) that flows through a resistor of 9 ohms, when the potential difference between the ends of the resistor is 36 V.
(a) 8 (b) 7
(c) 4 (d) 3

Ans : (c)

Given that,
resistance, R = 9 Ω,
Voltage, V = 36 volt
Current $I = \dfrac{V}{R} = 4$ Amp.

15. What will be the value of load impedance (in ohms) for transmitting maximum power from the source to load when the source impedance is 8 + j4 ohms?
(a) 8 – j4 (b) 8 + j4
(c) 4 + j8 (d) 4 – j8

Ans : (a) Given that,
Source impedance $(Z_S) = R_S + jX_S$
$= 8 + j4$
load impedance = ?
for maximum power transfer, $Z_L = Z_s{}^*$
$Z_L = (8 + j4)^*$
$$\boxed{Z = 8 - j4\ \Omega}$$

16. Determine the value of current (in A) drawn from the voltage source for the electrical circuit given below.
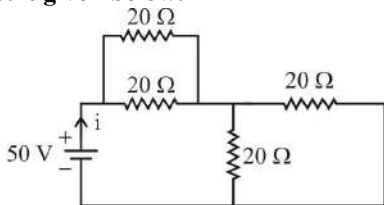
(a) 4 (b) 3.5
(c) 2.5 (d) 1.6

Ans : (c)
Given that, voltage V = 50 volt
$$R_1 = \frac{20 \times 20}{20 + 20} = \frac{400}{40} = 10\Omega$$
$$R_2 = \frac{20 \times 20}{20 + 20} = \frac{400}{40} = 10\Omega$$
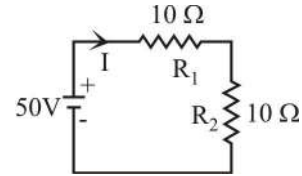
Now, R_1 and R_2 are connected in series, so
$R_{eq} = R_1 + R_2$
$R_{eq} = 10 + 10$
$R_{eq} = 20\ \Omega$
so, current $I = \dfrac{V}{R_{eq}}$
$$I = \frac{50}{20} = 2.5\ \text{Amp.}$$

17. Determine the load resistance (in ohms) for a circuit when the maximum power transferred from source of 80 V to the load is 80 W.
(a) 40 (b) 20
(c) 10 (d) 5

Ans : (b) Power, P = 80 watt
V = 80 volt
For maximum power transfer to load, $P_{max} = \dfrac{V^2}{4R_{th}}$
then,
$$R_{th} = \frac{V^2}{4P_m} = \frac{80 \times 80}{4 \times 80} = 20\ \Omega$$
So load resistance will be $R_L = R_S = 20\ \Omega$

18. Determine the Norton's resistance (in ohms) between terminals A and B for the circuit given below
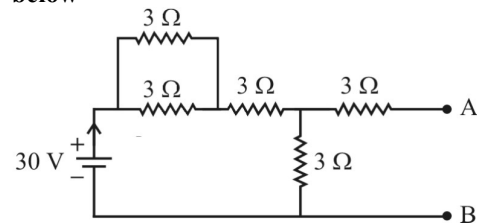
(a) 5.8 (b) 4.8
(c) 3.8 (d) 1.8

Ans : (b) For finding norton's resistance in the given circuit, voltage source will be short circuited and current source will be open circuited, then
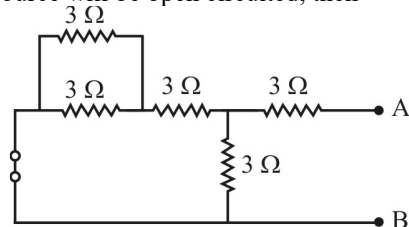
$R_1 = \dfrac{3 \times 3}{3+3} = 1.5$ (Q3Ω and 3Ω are connected in parallel)

$R_2 = 1.5 + 3$ (QR$_1$ and 3Ω are now in series)

$R_2 = 4.5\,\Omega$

$R_3 = \dfrac{R_2 \times 3}{R_2 + 3}$ (QR$_2$ and 3Ω now are in parallel)

$R_3 = \dfrac{4.5 \times 3}{4.5 + 3} = \dfrac{13.5}{7.5}$

$R_3 = \dfrac{9}{5}\Omega$

Norton's resistance (R_N)

$\quad = R_3 + 3$ (QR$_3$ and 3Ω are now in series)

$R_N = \dfrac{9}{5} + 3$

$R_N = \dfrac{24}{5}$

$\boxed{R_N = 4.8}$

19. **Determining the Thevenin's equivalent resistance (in ohms) across the terminal a and b for the electrical circuit given below.**
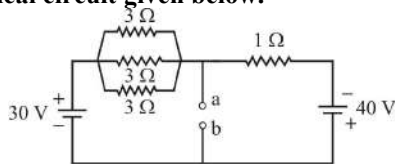
(a) 1   (b) 0.5
(c) 0.3   (d) 0.2

Ans : (b)
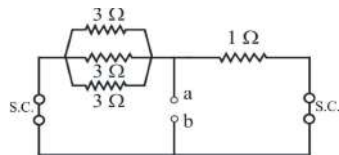
$\dfrac{1}{R} = \dfrac{1}{3} + \dfrac{1}{3} + \dfrac{1}{3} = 1$

$\boxed{R = 1\Omega}$
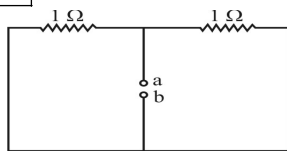
$R_{ab} = \dfrac{1 \times 1}{1+1}$

$R_{ab} = \dfrac{1}{2} = 0.5\,\Omega, \qquad R_{ab} = R_{th}$

$\boxed{R_{th} = 0.5\,\Omega}$

20. **Determine the value of current (in A) through 30 ohms resistor of the circuit given below**
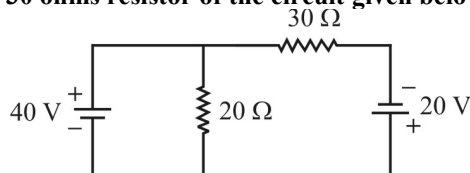
(a) 4   (b) 3
(c) 2   (d) 1

Ans : (c)
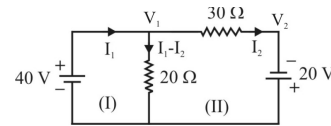
In the circuit, e.m.f. of 40V is in parallel with 20Ω resistance, so current flowing in 30Ω resistance is:

On applying nodal analysis,

$I = \dfrac{V_1 - V_2}{R} = \dfrac{40 - (-20)}{30} = 2\,\text{amp}$

21. **Which of the following is the dimensional formula for mutual inductance?**
(a) $ML^2T^2A^{-2}$ (b) $ML^2T^2A^2$
(c) $ML^2T^{-2}A^{-2}$ (d) $ML^{-2}T^{-2}A^2$

Ans : (c) Dimensional formula of mutual inductance is $[ML^2T^{-2}A^{-2}]$. Since the formula of mutual inductance is Henery, denoted as H. Its SI unit is $Kgm^2s^{-2}A^{-2}$.

22. **Which of the following is the CORRECT expression for hysteresis loss occurring in a material?**
(a) $\eta \times B_m^2 \times f^2 \times V$ (b) $\eta \times B_m^2 \times f^2 \times V^{2.5}$
(c) $\eta \times B_m^{1.6} \times f \times V$ (d) $\eta \times B_m^2 \times f^{1.6} \times V$

Ans: (c) Correct expression for hysteresis loss occurring a material is $\boxed{P_h = \eta \times B_{max}^{1.6} \times f \times v\,(watt)}$

where $\eta \Rightarrow$ Steinmetz's factor
$\quad\quad B_{max} \Rightarrow$ flux density
$\quad\quad f \Rightarrow$ frequency
$\quad\quad V \Rightarrow$ volume

Core is made from silicon steel to reduce the hysteresis loss.

23. **Which of the following expression satisfies the Faraday's law of electromagnetic induction?**

(a) $e = -\dfrac{Nd\phi}{dt}$ (b) $e = N|\dfrac{d\phi}{dt}$

(c) $e = -N\int d\phi\, dt$ (d) $e = \dfrac{Nd^2\phi}{dt^2}$

Ans : (a) Faraday's law of electromagnetic induction gives $e = -\dfrac{Nd\phi}{dt}$

where N is the number of turns.

$(-)$ sign shows lenz's law, which states that induced e.m.f. opposes the change in magnetic field which produced it.

24. **Which property of a material opposes the passage of magnetic flux through it?**
(a) Permeance   (b) Capacitance
(c) Inductance   (d) Reluctance

Ans : (d) Reluctance is the property of a magnetic circuit of opposing the passage of magnetic flux lines, and it is equal to the ratio of the magnetic motive force to the magnetic flux. $S = \dfrac{MMF}{flux} = \dfrac{NI}{\phi} = \dfrac{1}{\mu_0\mu_r a}\,AT/Wb$

Its unit is ampere-turn/weber or Henry^{-1}, value of Reluctance is zero for an ideal core because $(\mu_{r=\infty})$ for ideal condition.

25. Determine the intensity of magnetization (in A/m) of a magnet when the pole magnet is 30 A-m and the pole of the magnet is 2 sq.m.
(a) 60   (b) 30
(c) 25   (d) 15

Ans : (d) Intensity of magnetization of magnet,
$$I = \frac{m}{A}$$
where m = strength of pole = 30
A = Area = 2 m^2
$$I = \frac{30}{2} = 15 \, Amp/meter$$

26. What will be the produced mmf (in Amp-turns) in a coil, if the coil has 160 turns and carries a current of 0.15 A?
(a) 32   (b) 24
(c) 16   (d) 8

Ans : (b) Given that,
Number of Turns, (N) = 160 T
Current (I) = 0.15 Amp.
value of m.m.f. is equal to NI in a coil, so
mmf = N × I
mmf = 160 × 0.15
mmf = 24 Amp-turn

27. Determine the reluctance (in Amp-turns/Wb) of a coil, when the flux through the coil is 25 Wb and the value of produced mmf is 50 Amp-turns.
(a) 2   (b) 4
(c) 6   (d) 8

Ans : (a) Given that,
flux (φ) = 25 weber
mmf = 50 Amp-turn
$$Reluctance \, (S) = \frac{NI}{\phi} = \frac{MMF}{flux}$$
$$= \frac{50}{25} = 2 \, AT/Weber$$

28. Determine the magnetic field intensity (in Amp-turns/m) of 5 meter long coil when the coil has 100 turns and carries a current of 0.6 A.
(a) 15   (b) 12
(c) 10   (d) 8

Ans : (b) Given that, Number of Turns (N) = 100 T
current (I) = 0.6 Amp,   ℓ = 5 m
Intensity of magnetic field (H) = $\frac{NI}{l} = \frac{MMF}{flux} \times At/m$
$$= \frac{100 \times 0.6}{5} = 12$$
$$\boxed{H = 12 \, AT/m}$$

29. Determine the self-inductance (in mH) of a 3m long air-cored solenoid, when the coil has 300 turns and the diameter of the coil is 12 cm.
(a) 0.41   (b) 0.35
(c) 0.32   (d) 0.24

Ans : (a) Given that,
N = 300 Turns
$$d = 12 \, cm = .12m, \qquad r = \frac{d}{2} = 0.06m$$
$$\ell = 3 \, m$$
$$L = \frac{\mu_0 \mu_r N^2 A}{\ell} \quad (\mu_r = 1) \text{ for air}$$
$$L = \frac{4\pi \times 10^{-7} \times 1 \times 300 \times 300 \times \pi \times 0.06^2}{3}$$
$$L = \frac{4 \times 3.14 \times 10^{-7} \times 90000 \times 3.14 \times 0.0036}{3}$$
$$\boxed{L = 0.42 \, mH}$$

30. Determine the current (in A) through a 60 cm long solenoid when the solenoid has 400 turns and the value of magnetic field at the center of the solenoid is 6 mT.
(a) 4.4   (b) 5.6
(c) 7.2   (d) 8.4

Ans : (c) Given that,
length of solenoid, l = 60 cm = 0.6 m
No. of Turns (N) = 400 T
B = 6 × 10^{-3} Tesla
by   B = $\mu_o \mu_r$ H
$$H = \frac{B}{\mu_o \mu_r}$$
$$\frac{NI}{l} = \frac{B}{\mu_o \mu_r} \qquad \left(Q H = \frac{NI}{l} \right)$$
$$current \, I = \frac{Bl}{\mu_o \mu_r N} = \frac{6 \times 10^{-3} \times 0.6}{4\pi \times 10^{-7} \times 400} \quad (Q\mu_r = 1 \, Air)$$
current $\boxed{I = 7.2 \, Amp.}$

31. Determine the root means square value (in V) of the voltage waveform given in the figure below.
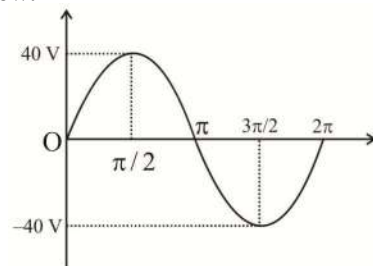
(a) 56.56   (b) 46.52
(c) 32.25   (d) 28.29

Ans : (d) given that,
Maximum value of voltage = 40 volt
so, r.m.s. value of voltage
$$V_{r.m.s} = \frac{Maximum \, value \, (V_{max})}{\sqrt{2}}$$
$$V_{rms} = \frac{40}{\sqrt{2}} = \frac{40}{1.414}$$
$$V_{rms} = 28.29 \, volt$$

32. Determine the time-period (in ms) of a sinusoidal waveform when the frequency of the waveform is 60 Hz.
(a) 16.67   (b) 18.26
(c) 20.24   (d) 26

Ans : (a) Given that,
frequency, f = 60 Hz

Time period $(T) = \dfrac{1}{f}$ second

$T = \dfrac{1}{60} = 0.01667$ second

$\boxed{T = 16.67 \text{ m sec}}$

33. Which of the following is the unit of frequency of an AC signal?
(a) Hertz/Second   (b) Revolution
(c) Hertz   (d) Revolution/second

Ans : (c) Alternating current (AC) frequency is the number of cycles per second of an AC sine wave. Frequency is the rate at which current changes direction per second. It is measured in hertz (Hz) an international unit of frequency. where, 1 Hz = 1 cycle/sec.

34. Which one of the following is the CORRECT relation between the peak value and RMS value of current for a sine wave?
(a) $I_{rms} = 0.06 \, I_p$ (b) $I_{rms} = 0.87 \, I_p$
(c) $I_{rms} = 1.414 \, I_p$ (d) $I_{rms} = 0.707 \, I_p$

Ans : (d) Relation between the peak value and R.M.S. value of current for a sine wave is,

$I_{rms} = \dfrac{I_P}{\sqrt{2}}$

$\boxed{I_{rms} = 0.707 \, I_P}$

35. Determine the average value of alternating voltage (in V) when the peak value of the voltage is 120 V.
(a) 76.44   (b) 86.34
(c) 110.34   (d) 188.38

Ans : (a) Given that,
Peak value of voltage V_m = 120 V

Average value of signal , $V_{av} = \dfrac{2V_m}{\pi}$

$V_{av} = 0.637 \times V_m$
$V_{av} = 0.637 \times 120$
$V_{av} = 76.44$ volt

36. What will be the capacitance (in mF) of a circuit which is supplied with a 50 Hz frequency and the capacitive reactance of the circuit is 40 ohms?
(a) 0.4   (b) 0.8
(c) 1.4   (d) 2.6

Ans : (*) Given that,
Capacitive reactance $(X_c) = 40\Omega$
frequency (f) = 50 Hz

We know that $(X_c) = \dfrac{1}{2\pi fC}$

then, $C = \dfrac{1}{2\pi fX_c}$

$C = \dfrac{1}{2 \times 3.14 \times 50 \times 40} = \dfrac{1}{314 \times 40} = \dfrac{1}{12560}$

$C = 0.08$ mF

Note- None of the given option is correct.

37. Determine the total power (in kW) consumed by a 3-phase delta connected system supplied by a line voltage of 240 V when the value of phase current is 20 A and the current lags the voltage by 60 degree.
(a) 9.4   (b) 8.6
(c) 8.2   (d) 7.2

Ans : (d) Given that, line voltage, V_L = 240 volt
Phase current I_{ph} = 20 Amp
Line current $I_L = \sqrt{3} \, I_{ph} = \sqrt{3} \times 20$

$\phi = 60^\circ$
$P = \sqrt{3} \, V_L I_L \cos\phi$
$P = \sqrt{3} \times 240 \times \sqrt{3} \times 20 \cos 60$
$P = 3 \times 4800 \times \dfrac{1}{2}$
$P = \dfrac{14400}{2} = 7200$ watt

$\boxed{P = 7.2 \text{ kW}}$

38. Determine the capacitive susceptance (in Siemens) of a circuit if the capacitor of the circuit is 0.08 mF and supplied with a 50 Hz frequency.
(a) 0.025   (b) 0.034
(c) 0.046   (d) 0.064

Ans : (a) capacitance (C) = 0.08×10^{-3} farad
supply frequency (f) = 50 Hz

Capacitive susceptance (B) = $\dfrac{1}{X_c}$

$B = \dfrac{1}{\dfrac{1}{2\pi fC}}$

$B = 2\pi fC = 2 \times \pi \times 50 \times 0.08 \times 10^{-3}$
$= 2 \times 3.14 \times 50 \times 0.08 \times 10^{-3}$
$= 25.12 \times 10^{-3}$

$\boxed{B = 0.025 \text{ siemens}}$

39. What will be the transient time (in seconds) of a series RC circuit when the value of the capacitance is 600 microfarad and the value of the resistance is 20 kilo-ohms?
(a) 10   (b) 12
(c) 14   (d) 16

Ans : (b) Capacitance (C) = 600×10^{-6} farad
Resistance (R) = $20 \times 10^3 \, \Omega$
transient time of series RC circuit $(\tau) = R \times C$
so $\tau = 20 \times 10^3 \times 600 \times 10^{-6}$
$\tau = 12000 \times 10^{-3}$
$\tau = 12$ second

40. What will be the resonant frequency (in kHz) of a tank circuit when the capacitance and inductance of the circuit is 0.04 mF and 0.04 mH respectively?
(a) 8   (b) 6
(c) 4   (d) 1

Ans : (c) Capacitance (C) = 0.04×10^{-3} farad
Inductance, (L) = 0.04×10^{-3} Henry

Resonance frequency $(f_r) = \dfrac{1}{2\pi\sqrt{LC}}$

$= \dfrac{1}{2\pi\sqrt{0.04\times10^{-3}\times0.04\times10^{-3}}}$

$= \dfrac{1}{2\times3.14\sqrt{0.04\times10^{-3}\times0.04\times10^{-3}}}$

$= \dfrac{1}{2\pi\times0.04\times10^{-3}}$

$\boxed{f_r = 4\,KHz}$

41. Multimeters cannot measure the value of........
(a) voltage   (b) current
(c) resistance   (d) phase angle

Ans : (d) Multimeter cannot measure the value of phase angle. A multimeter is used to measure voltage, current and resistance of any electrical circuit, multimeter is also not used to measure frequency. Multimeters are of two type → Analog multimeter and digital multimeter.

42. Which of the following statement is TRUE?
(a) A galvanometer can be converted into ammeter by connecting a low value of resistance in series with the galvanometer.
(b) A galvanometer can be converted into ammeter by connecting a low value of resistance in parallel with the galvanometer.
(c) A galvanometer can be converted into ammeter by connecting a high value of resistance in series with the galvanometer.
(d) A galvanometer can be converted into ammeter by connecting a high value of resistance in parallel with the galvanometer.

Ans : (b) A galvanometer can be converted into ammeter by connecting a low value of resistance in parallel with the galvanometer. Galvanometer is a very low current measuring device. Generally it is used to detect the presence of flow of current in any circuit.

43. Which of the following statement is TRUE about megger?
(a) Megger is used to the measurement of voltage.
(b) Megger is used for the measurement of current.
(c) Megger is used for the measurement of insulation resistance.
(d) Megger is used for the measurement of breakdown voltage of insulation.

Ans : (c) Megger is a measuring instrument used for the measurement of insulation resistance of an electrical system. An electrical system degrades its quality of insulation resistance with time and various environmental conditions including temperature, moisture dust particles and humidity. Its speed lies between 130 rpm to 170 rpm.

44. Which of the following bridge is most suitable for the measurement of inductance of a coil?
(a) Owen's Bridge   (b) Schering Bridge
(c) Wein's bridge   (d) Wheatstone bridge

Ans : (a) Owen's Bridge is most suitable for the measurement of inductance of a coil. It works on the principle of comparison i.e. the value of the unknown inductor is compared with the standard capacitor. It is used to measure inductance of low Q factor coils. It can also measure in cremental inductance.
Schering Bridge:- Is used for the measurement of, unknown capacitance, dielectric loss, power factor.

45. Determine the required value of series resistance (in Ohms) to convert a galvanometer into a voltmeter of reading 0.4 volt range when the resistance of the galvanometer is 40 ohms and the value of current to full-scale deflection is 4 mA.
(a) 60   (b) 50
(c) 40   (d) 30

Ans : (a) $I_m = 4 \times 10^{-3}$ Amp.
$\quad$ V = 0.4 volt
$\quad$ $R_m = 40\Omega$
$\quad$ $I = \dfrac{0.4}{40} = 0.01$ Amp.
$\quad$ $m = \dfrac{I}{I_m} = \dfrac{0.01}{4\times10^{-3}} = 2.5$
$\quad$ $R_s = R_m(m-1) = 40(2.5-1) = 40 \times 1.5$
$\quad$ $R_s = 60\Omega$
So, value of series resistance $R_s = 60\ \Omega$
Alternate solution-
$R_s = \dfrac{V}{I_m} - R_m$

$= \dfrac{0.4}{4\times10^{-3}} - 40 \Rightarrow 100 - 40$

$R_s = 60\ \Omega$

46. What will be the sensitivity (in Ohms/volts) of a PMMC type voltmeter when the full-scale reading of the voltmeter is 240 V, the internal resistance of the voltmeter is 200 kilo-Ohms and the series resistance connected to the voltmeters is 80 kilo-Ohms?
(a) 1672.62   (b) 1432.23
(c) 1224.24   (d) 1166.67

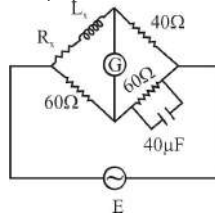**Ans : (d)** V = 240 volt
Total value of internal resistance and series resistance of meter = 200 + 80 kΩ = 280 kΩ
Sensitivity of voltmeter $(S_v) = \dfrac{1}{I_m} = \dfrac{R}{V} = \dfrac{\Omega}{V}$

$= \dfrac{280\times10^3}{240}$

$= 1166.67\ \Omega/V$

47. Determine the value of unknown inductance L_x, (in mH) and the effective resistance R_x (in Ω) of inductor respectively for the circuit given below, if no current flows through the galvanometer (G).

(a) 46, 20   (b) 56, 30
(c) 64, 46   (d) 96, 40

Ans : (d) Given that,

$R_3 = 40\Omega$, $R_2 = 60\Omega$
$R_4 = 60\Omega$, $C_4 = 40\mu F$
$R_x = ?$, $L_X = ?$

Given circuit is of Maxwell inductance-capacitance bridge, so

unknown resistance, $\boxed{R_x = \dfrac{R_2 R_3}{R_4}}$

$= \dfrac{60 \times 40}{60}$

$\boxed{R_x = 40\Omega}$

unknown inductance $\boxed{L_x = R_2 R_3 C_4}$

$= 60 \times 40 \times 10^{-6} \times 40$

$= 96000 \times 10^{-6}$

$\boxed{L_x = 96\,mH}$

48. What will be the value of reactive power (in VAR) of a circuit having power factor of 0.5, when the apparent power of the circuit is 80 VA?

(a) 48   (b) 69.6
(c) 78.3   (d) 84

Ans : (b) Given that, $\cos\phi = 0.5$
Apparent power = 80VA
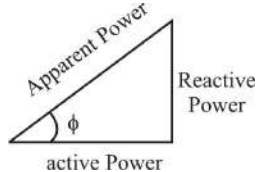
Reactive power

$= \sqrt{\left(\text{Apparent power}\right)^2 - \left(\text{Active power}\right)^2}$

active power $P = VI \cos\phi$
$\qquad\qquad\quad P = 80 \times 0.5$
$\qquad\qquad\quad P = 40\ watt$

Reactive power $= \sqrt{(80)^2 - (40)^2}$

$= \sqrt{6400 - 1600}$

$= \sqrt{4800} = 69.2$

Reactive power ; 69.6 VAR

49. Determine the secondary voltage (in V) of a potential transformer when the value of the system voltage is 11,000 V, the turn's ratio of the potential transformer is 102 and the percentage voltage error of the transformer is 3%.

(a) 102.5   (b) 104.6
(c) 108.8   (d) 109.4

Ans : (b) Given that,
Voltage error = 3% Turn ratio = 102
Primary voltage = 11000 V

secondary voltage $= \dfrac{11000}{102} = 107.84\,V$

$V_T = 107.84\,V$ Measured secondary voltage $V_m = ?$

% Voltage error $= \dfrac{V_T - V_m}{V_T} \times 100$ If $\boxed{V_m < V_T}$

$\dfrac{3}{100} = \dfrac{107.84 - V_m}{107.84}$

$-V_m = 0.03 \times 107.84 - 107.84$
$V_m = 104.6\,V$

50. Determine the quality factor for Maxwell's inductance capacitance bridge given below when the bridge is supplied by a frequency of 50 Hz.
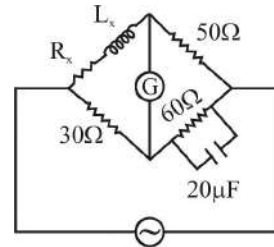
(a) 0.3   (b) 0.4
(c) 0.6   (d) 0.8

Ans : (b) Given that,
$R_2 = 50\Omega$, $R_3 = 30\Omega$
$R_4 = 60\Omega$, $C_4 = 20\mu F$
$f = 60\,Hz$

Quality factor $(Q) = \omega R_4 C_4$

$= 2\pi f\, R_4 C_4$

$= 2 \times 3.14 \times 50 \times 60 \times 20 \times 10^{-6}$

$= 0.376$

$\boxed{Q = 0.4}$

51. In dc machine iron losses cause
(a) heating in core
(b) less in efficiency
(c) rise in temperature of ventilating air
(d) all of the mentioned

Ans : (d) In dc machine iron losses cause heating in core resulting efficiency decreases.

52. Armature current at starting can be reduced by keeping
(a) R_f maximum and R_a minimum
(b) R_a maximum and R_f maximum
(c) R_a minimum and R_f minimum
(d) R_a maximum and R_f minimum

Ans : (d) Armature current at starting can be reduced by keeping armature resistance (R_a) maximum and field resistance (R_f) minimum. Generally value of armature resistance is kept low and value of field resistance is kept high. If D.C. machine works as a generator then value of field resistance should be always below to critical field resistance.

53. In dc motors, under leading pole tips flux density will
   (a) increase
   (b) decrease
   (c) either increase or decrease
   (d) None of these

Ans : (a) In D.C. motor, under leading pole tips flux density will increase due to armature reaction at leading pole tip magnetization and at trailing pole tip demagnetization will occur.

54. The field winding will be drawn at what degree?
   (a) 60 degree   (b) 30 degree
   (c) 90 degree   (d) 180 degree

Ans : (*) No correct answer according to commission.

55. Compensating winding is placed in the
   (a) pole shoe   (b) armature core
   (c) main field   (d) all option are correct

Ans : (a) Compensating winding is place in the pole shoe. This winding is also known as pole face winding. It is connected in series with the armature winding so that their mmf are proportional to the same current to compensate the effect of armature reaction. The direction of current in compensating winding must be opposite.
The main purpose of compensating winding is to nullify the effect of armature reaction on the main field flux under the pole faces in DC machine.

56. Stepped cores are used in transformers in order to reduce
   (a) volume of iron   (b) volume of copper
   (c) iron loss   (d) reluctance of core

Ans : (b)

Stepped core transformer
Cruciform or stepped core reduces the diameter of circumscribing. Due to the less diameter the insulating material required is less and amount of copper required for winding is reduced. Due to above reason size, weight and cost of Transformer is less with cruciform care.

57. In a transformer the resistance between its primary and secondary is
   (a) zero   (b) 1 ohm
   (c) 1000 ohms   (d) infinite

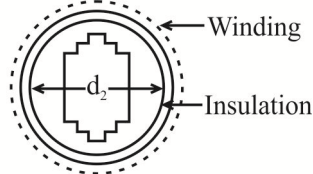**Ans : (d)** In a transformer the primary and secondary windings are not electrically connected therefore the resistance between them is ideally infinite but an auto transformer does the same using a single coil as primary with one or more tap for secondary in different parts of the coil. In this case the resistance will ideally be zero or a short circuit.

58. In a transformer zero voltage regulation is achieved at a load power factor which is
   (a) zero   (b) leading
   (c) lagging   (d) Unity

Ans : (b) At certain leading power factor we get $E_2 = V_2$ and the regulation become zero. If the load increased further E_2 become less than V_2 and we get negative regulation this is the leading power factor (p.f.) at which voltage regulation becomes zero while supplying the load.

59. In the induction motors the torque is directly proportional to the
   (a) slip1/3   (b) higher slip values
   (c) voltage slip   (d) lower slip values

Ans : (d) $T = \dfrac{K\phi sE_2 R_2}{R_2^2 + (sX_2)^2}$

When slip 's' has very low value, speed of rotor is equal to synchronous motor, then value of R_2 is greater than the value of SX_2 because rotor frequency is very low as
$\boxed{f_r = sf}$

In this case $T \propto \dfrac{S}{R_2}$ $\boxed{T \propto S}$

so,
In this condition curve of torque-slip is a straight line. When slip 's' has high value, speed of rotor decreases and achieves maximum torque.
So, $R_2 = SX_2$ (Its also known as full out torque)

$T \propto \dfrac{S}{(SX_2)^2}$

$\boxed{T \propto \dfrac{1}{S}}$ $\left[Q\ X_2 = \text{constant} \right]$

In this condition curve of torque slip is a rectangular parabolic shape.

60. In induction motor If we remove on phase for instance, two terminals will have 'Y' phase and one will have 'B' phase called
   (a) AC dynamic Breaking
   (b) plugging
   (c) cascade breaking
   (d) increasing motor torque

Ans : (a) In induction motor, when a phase is removed, e.g. there will be two terminals "Y" phase and one terminal will have "B" phase braking to A.C. is called dynamic restriction. This braking during the motor slip (1–S) becomes of this braking disconnected the motor's stator from the 3-ϕ supply and has a given d.c. supply in his stator.

61. In a capacitor start single-phase induction motor, the capacitor is connected
  (a) in series with main winding
  (b) in series with auxiliary winding
  (c) in series with both the winding
  (d) in parallel with auxiliary winding

Ans : (b) In a capacitor start single phase induction motor, the capacitor is connected in series with auxiliary winding. Single phase induction motor are not self-starting without an auxiliary stator winding driven by an out of phase current of near 90° once started the auxiliary winding is removed.

62. If running winding of a single-phase induction motor is short circuited
  (a) run slower
  (b) spark at light loads
  (c) draw excessive current and overheat
  (d) None of these

Ans : (c) If running winding of a single phase induction motor is short circuit it draw excessive current and overheat.

63. Short circuit is used in
  (a) repulsion induction motor
  (b) repulsion motor
  (c) repulsion start induction run motor
  (d) None of these

Ans : (c) The repulsion –start induction run motor has the same general construction of a repulsion motor. The only difference is that in addition to the basic repulsion-motor construction. It is equipped with a centrifugal device fitted on the armature shaft.
When the motor reaches 75% of its full running speed, the centrifugal device force a short-circuiting ring to come in contact with the inner surface of the commutator. This short circuits all the commutator bars. The rotor then resembles squirrel cage type and the motor runs as a single phase induction motor.

64. Which of the following statements regarding repulsion-start induction motor is incorrect?
  (a) It requires more maintenance of commutator and other mechanical devices
  (b) It makes quite a bit of noise on starting
  (c) In fractional horse power motors, it has replaced the capacitor motors
  (d) It is not easy reversed

Ans : (c) In Repulsion start induction motor requires more maintenance of commutator and other mechanical device it makes quite a bit of noise starting and it is not easy reversed so option (c) is incorrect.

65. In a two value capacitor motor, the capacitor used for running purpose is
  (a) air capacitor
  (b) paper spaced oil filled type
  (c) ceramic type
  (d) a.c. electrolytic type

Ans : (b) In a two value capacitor motor the capacitor used for running purpose is paper spaced oil filled type. While starting purpose electrolytic capacitor is used. The value of starting capacitor of a fractional horse power (FHP) motor will be 300μf.

66. Speed control of a universal motor is achieved by
  (a) varying field flux with tapped field windings
  (b) connecting rheostat in series
  (c) applying variable voltage
  (d) all of these methods

Ans : (d) speed control of universal method is achieved by all of these methods.

67. In any case, where the height of transmission tower is increased
  (a) the line capacitance and inductance will not change
  (b) the line capacitance and inductance will decrease
  (c) the line capacitance will decrease and line inductance will increase
  (d) the line capacitance will decrease but line inductance remain unchanged

Ans : (d) If the height of transmission tower is increased the line capacitance will decrease line capacitance depend on distance from earth to wire while inductance does not depend.

$$C = \frac{\varepsilon_0 A}{d}$$

$$C \propto \frac{1}{d}$$

68. For transmission lines, steel poles are generally used because:
  A. It has more mechanical strength and more life
  B. It occupies less space and give better appearance
  C. It has high cost
  (a) Only A   (b) Only B
  (c) Both A and B   (d) Only C

Ans : (c) For transmission line steel poles are generally used because it has more mechanical strength and more life and it occupies less space and give better appearance.

69. A synchronous generator generates reactive power while working at
  (a) zero power factor
  (b) lagging power factor
  (c) leading power factor
  (d) Any of these

Ans : (b) A synchronous generator generates reactive power while working at lagging power factor.

70. The bedding of a cable consist of.
  (a) jute
  (b) hessian cloth
  (c) both jute and hessian cloth
  (d) None of these

Ans : (c) Bedding is provided to protect the metallic seath from corrosion and from mechanical damage due to armoring. It is a fibrous material like jute or hessian tape.

71. Setting depth of poles is
  (a) 1/4 part of the length of pole
  (b) 1/5 part of the length of pole

(c) 1/8 part of the length of pole
(d) 1/2 part of the length of pole

Ans : (b) The depth to set the pillar is 1/5 of the pillar that is the height of the pillar is up to 5th of it height is length to be established inside the land of the pillar. Generally 1/6 of the total of the pole is taken but it can vary according to the condition of the land.

72. **The protective device which will not open the circuit even after 4 h when the current is 1.5 times the excess of the rated current will be**
(a) HRC fuses   (b) cartridge fuses
(c) circuit breaker   (d) rewirable fuses

Ans : (a) The protective device which will not open the circuit even after 4 h when the current is 1.5 times the excess of the rated current will be HRC fuses.

73. **Power factor of fluorescent lamp is about**
(a) zero   (b) 0.5 lead
(c) unity   (d) 0.5 lag

Ans : (d) Power factor (P.F.) of the Fluorescent lamp is low about 0.5 lagging due to the inclusion of a choke. A condenser, is connected across the supply may improve the P.F. to about 0.95 lagging. Higher fluctuating voltage reduces the useful life of the tube light to very great extent.

74. **Which type of fire extinguisher is not suitable for electric fire**
(a) foam extinguisher
(b) carbon dioxide extinguisher
(c) soda acid extinguisher
(d) dry powder extinguisher

Ans : (a) Foam extinguisher is not suitable for electric fire. Fire extinguisher used for electric fire are carbon dioxide extinguisher, soda acid extinguisher, dry powder extinguisher etc.

75. **Fuse is inserted in series in the circuit and protect the equipment from**
(a) High voltage   (b) High current
(c) High power   (d) High energy

Ans : (b) Fuse is inserted in series in the circuit and protect the equipment from high current. Fuse wire is always connected with phase wire or live wire. Fuse wire should never be attached in neutral wire.

76. **In which portion of the transmission system faults occur most frequently?**
(a) under ground cables (b) transformers
(c) over head lines   (d) alternators

Ans : (c) Transmission system faults occurs most frequently in over head lines. Line to ground fault (L-G) is most common fault and 65-70% of faults are of this type. These faults occurs due to weather conditions equipment failures etc.

77. **Which connect the consumer's terminals to the distribution**
(a) distributors   (b) service mains
(c) feeder   (d) substation

Ans : (b) The main function of an electrical power distribution system is to provide power to individual consumer premises. Distribution of electrical power to different consumers is done with much low voltage level. Distribution networks consist of distribution substation, primary distribution, distribution transformer, distributors, service mains. Where service mains connect the consumer's terminals to the distribution.

78. **The earth pit should not be located near**
(a) roads   (b) rail tracks
(c) pavements   (d) all option are correct

Ans : (d) The earth pit should not be located near roads rail tracks and pavements. Difference between earth pit and place where is to be done should be minimum 1.5 m distance. Material of earth wire and earth electrode should be same. Earthing is done for safety of human life, building, equipment, voltage stabilization, over voltage protection etc.

79. **What will happen if field winding is disconnected accidently from rotating dc shunt motor?**
(a) motor suddenly off
(b) motor will run normally
(c) motor will run dangerously
(d) any of the above

Ans : (c) If field winding is disconnected accidently from rotating dc shunt motor, motor will run very dangerously because value of flux will be zero, when field winding disconnected. So, Machine will run at infinite speed.

$$N \propto \frac{1}{\phi}$$

When $\phi = 0$ $N = \infty$

80. **In dc generator, wave winding is used for which type of machines**
(a) high voltage low current
(b) high current low voltage
(c) high voltage high current
(d) low voltage low current

Ans : (a) Wave winding is used in D.C. generator for high voltage and low current where as lap winding is used in D.C. generator for high current and low voltage.

81. **The space to height ratio in illumination lies between**
(a) 1 to 200   (b) 1 to 20
(c) 1 to 2   (d) 1 to 2000

Ans : (c) The space to height ratio in illumination lies between 1 to 2. Spacing height ratio is defined as the ratio of the distance between adjacent luminaries (center to center) to their height above the working place.

82. **Molded case circuit breaker is used for**
(a) over load and short circuit protection
(b) over load protection
(c) short circuit protection
(d) open circuit protection

Ans : (a) Molded case circuit breaker is used for over load and short circuit protection. Rating of circuit breaker is generally in MVA. It is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. It has two type-
1. Automatic 2. Manually

83. Which of the following will need lowest level of illumination?
   (a) Displays   (b) Fine engraving
   (c) Railway platform   (d) Auditoriums

Ans : (c) Railway platform will need lowest level of illumination.
Table of illumination level

S.N.	Place and Work	Illumination Level (In LUX)
1.	In Education Institute	
	(i) Drawing Hall	500–1000
	(ii) Laboratory	200–500
	(iii) Class-room	250–300
2.	In Hospital	
	(i) Workplace (First aid)	500
	(ii) Operation room	500–1000
	(iii) On operation table	2000
3.	In Hotels and restaurants	
	(i) Lunch room	100–150
	(ii) Kitchen	200–300
4.	Factory and Workshop	
	(i) Welding, Carpentry etc.	200–500
	(ii) Fitting assembly	500–1000
	(iii) Tiny machine	1000–2000
	(iv) Very tiny machines	250–500
5.	Assembly room, Library, Railway Platform	250–500
6.	Design of Drawing, watch maintains, Maintains of electronic equipment etc.	1000–2000

84. A mercury vapour lamp gives
   (a) Pink light   (b) Yellow light
   (c) Greenish blue light   (d) White light

Ans : (c) A mercury vapour lamp gives greenish blue light.
Note– In revised answer key, commission decided white light as a correct answer.

85. Heat is transferred simultaneously by conduction, convection and radiation............
   (a) Inside boiler furnaces
   (b) During melting of ice
   (c) Through the surface of the insulated pipe carrying steam
   (d) From refrigerator coils to freezer of a refrigerator

Ans : (a) Heat is transferred simultaneously by conduction, convection and radiation inside boiler furnaces. Boiler is a type of closed vessel, in which water is converted into steam. It is of two type
(1) Fire Tube Boiler
(2) Water Tube Boiler
Presently water tube type boiler is used maximum.

86. Heavy duty steel works cranes having wide load variations are equipped with
   (a) DC series motors
   (b) Plain squirrel cage induction motors
   (c) Wound-rotor induction motors
   (d) Synchronous motors

Ans : (a) Heavy duty steel works cranes which have wide load variations are equipped with dc series motors supplied from a constant voltage dc power supply. The basic speed control is inherent in the motor speed regulation. Series connected tapped resistance banks are switched to provide current limiting on starting and low speed operation.

87. In induction heating
   (a) Heat is produced due to currents induced in the charge by electro-magnetic action.
   (b) The resistance of the charge must be low and voltage applied must be high in order to produce sufficient heat.
   (c) Magnetic materials can be easily treated in comparison to non-magnetic materials.
   (d) All option are correct

Ans : (d) In induction motor, heat is produced due to currents induced in the charge by electro-magnetic action. The resistance of the charge must be low and voltage applied must be high in order to produce sufficient heat, and magnetic materials can be easily treated in comparison to non-magnetic materials. Heating method can be used for magnetic and non-magnetic material both.

$$P = \frac{(4.44 f N \phi)^2}{R}$$

Heating method is a frequency dependent and use high frequency for above.

88. The depth of penetration, in the case hardening of a steel pulley, required is 105 mm. The relative permeability is unity and the resistivity for steel is 5×10^{-7} Ω-m. Determine the frequency required.
   (a) 56.3 KHz   (b) 46.7 KHz
   (c) 52.7 KHz   (d) 58.6 KHz

Ans : (*) depth of penetration

$$S = \sqrt{\frac{\rho}{\pi f \mu_0 \mu_r}} \Rightarrow \sqrt{\frac{5 \times 10^{-7}}{\pi \times f \times 1 \times 4\pi \times 10^{-7}}}$$

$$(0.105)^2 = \frac{5}{4\pi^2 \times f}$$

$$f = \frac{5}{4\pi^2 \times (0.105)^2} = 11.48 \text{ Hz}$$

89. When an electron breaks a covalent bond, and moves away
   (a) the semiconductor becomes conductor
   (b) a valency is created in broken covalent bond
   (c) the conductivity of the material increases
   (d) More ions are produced
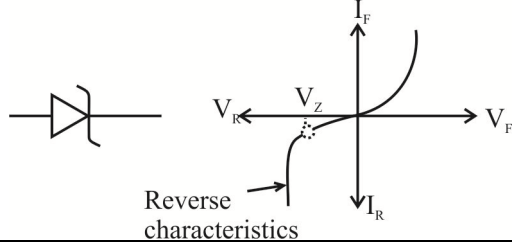
Ans : (*) Above all options are correct.
Note– Commission decided No correct answer है।

90. A zener diode is invariably used with
   (a) forward bias
   (b) reverse bias
   (c) either forward bias or reverse bias
   (d) zero bias

Ans : (b) Zener diode is always used in reverse bias. Zener diodes are used for voltage regulation.

Zener breakdown approximately 6V or (6V-8V)

Reverse characteristics

91. In a full wave rectifier diode conduct for
    (a) one half cycle   (b) full cycle
    (c) alternator half cycle   (d) None of these

Ans : (c) In a full wave rectifier diode conducts for alternate half cycle. It converts an ac voltage into a pulsating dc voltage using both half cycles of the applied ac voltages. The output of the full wave rectifier has lesser ripple than that of the half wave rectifier producing a relatively smoother output waveform. Efficiency of full wave rectifier is 81.2% and ripple factor is about 0.84.

92. I_{CEO} is related to I_{CBO} by
    (a) $I_{CEO} = (\beta+1) I_{CBO}$
    (b) $I_{CEO} = I_{CBO}$
    (c) $I_{CEO} = \alpha.I_{CBO}$
    (d) None of these

Ans : (a) We know that, $I_E = I_B + I_C$ .... (i)

$$I_C = \alpha I_E + I_{CBO} \quad \text{.......(ii)}$$
$$I_C = \alpha(I_B + I_C) + I_{CBO}$$
$$I_C = \alpha I_B + \alpha I_C + I_{CBO}$$
$$I_C(1-\alpha) = \alpha I_B + I_{CBO}$$
$$I_C = \frac{\alpha}{1-\alpha}I_B + \frac{1}{1-\alpha}I_{CBO} \quad \text{..... (iii)}$$

From eqⁿ (iii), It is apparent that if IB=0 (ie, base circuit is open), the collector current will be the current to the emitter. That is abbreviated as I_{CEO} meaning collector – emitter current with base open.

$$I_{CEO} = \frac{1}{1-\alpha}I_{CBO} \text{ [substituting the value in eqⁿ (iii)]}$$

$$I_C = \frac{\alpha}{1-\alpha}I_B + I_{CEO}$$

$$\boxed{I_C = \beta I_B + I_{CEO}}$$

$I_E = I_C + I_B$
$I_E = (\beta I_B + I_{CEO}) + I_B$
$I_E = (\beta+1)I_B + I_{CED}$

$$\left(\frac{1}{1-\alpha} = \beta\right)\left[I_{CEO} = \frac{1}{1-\alpha}I_{CBO} = (\beta+1)I_{CBO}\right]$$

93. If the temperature increases, the value of V_{BE}
    (a) remains the same
    (b) is increased
    (c) is decreased
    (d) None of these

Ans : (c) $V_{BE} = V_{CC} - I_C R_B$
$$I_C = \beta I_B$$
$$V_{CE} = V_{CC} - I_C R_C$$

If temperature increase the leakage current (I_{CBO}) increase while collector current increase

$$I_C = \beta I_B + (\beta+1)I_{CBO}$$

from collector current increase V_{BE} and V_{CE} both decrease.

94. In case of the CE amplifier the output voltage waveform is
    (a) in phase with input voltage waveform
    (b) always lag by 90° with respect to input voltage wave form
    (c) always lagging by 180° with respect to input voltage waveform
    (d) always lagging by 90° with respect to input voltage wave form

Ans : (c) In the case of the CE amplifier the output voltage waveform is always 180° out of phase with respect to input voltage waveform. CE amplifier configuration is widely used due to its advantage of moderate current and voltage gain. It is used in frequency generation circuit to increase the strength of input signal. It is used to increase the speed of fans, motors and timer circuits.

95. In a synchronous motor the maximum developed torque occurs at a coupling angle of
    (a) 180° (b) 90°
    (c) 60° (d) 30°

Ans : (b) In a synchronous motor, at 90° maximum torque occur

$$P_m = \frac{E_b V}{X_s}\sin\alpha \quad \alpha = 90^0$$

$$\boxed{P_m = \frac{E_b V}{X_s}}$$

96. Which of the following motors will be used in electric clocks
    (a) D.C. series motor
    (b) D.C. shunt motor
    (c) A.C. synchronous motor
    (d) A.C. induction motor

Ans : (c) Synchronous motor are used for applications where precise and constant speed is required. Low power application of these motor include positioning machine. These are also applied in robot actuators, Ball mills, clocks, record player turntables also make used of synchronous motors.

97. The power developed by a synchronous motor will be maximum when the load angle is..........
    (a) 45° (b) 90°
    (c) 120° (d) 0°

Ans : (b) The power developed by a synchronous motor will be maximum when the load angle is 90°

$$P_m = \frac{E_b V}{X_s}\sin\alpha \quad \alpha = 90^0$$

$$\boxed{P_m = \frac{E_b V}{X_s}}$$

98. In a synchronous motor, damper windings are placed on
(a) rotor shaft   (b) stator frame
(c) pole faces   (d) None of these

Ans : (c) In a synchronous motor, damper winding are placed on pole faces. which makes the synchronous machine self starting by providing starting torque. It also prevents from hunting.

99. In a three phase synchronous motor, if one of the winding is short circuited then the motor will
(a) run at 1/4 of synchronous speed
(b) not start
(c) run with excessive vibrations
(d) rotate at less than the rated load

Ans : (b) In 3-φ synchronous motor, if one of the winding is short circuit then motor will not start.

100. The magnitude of stator back e.m.f. (E$_b$) of a synchronous motor depends on
(a) d.c. excitation only
(b) load on the motor
(c) both the speed and rotor flux
(d) None of these

Ans : (a) In synchronous motor stator back emf (E$_b$) depends on DC excitation only, because flux produced by rotor are cut by stationary stator conductor and induces emf which opposes the cause or supply voltage due to lenz's law and this induced emf is stator back emf.

REASONING

101. In the following question, select the related word pair from the given alternatives.
Rain : Clouds :: ? : ?
(a) Rice : Food   (b) Grey : Color
(c) Heat : Sun   (d) Snow : Mountains

Ans : (c) Just as the rain is related to clouds in the same way heat is related to sun.

102. In the following question, select the related word from the given alternatives.
Cactus : Plant :: Rice : ?
(a) Basmati   (b) Crop
(c) White   (d) Rabi

Ans : (b) Just that the Cactus is the type of plant similarly the Rice is the type of crop.

103. In the following question, select the related word from the given alternatives.
Pink : Color :: Eagle : ?
(a) Black   (b) Symbol
(c) Bird   (d) Sky

Ans : (c) Just that the Pink is type of color in the same way Eagle is the type of Bird.

104. In the following question, select the related letter pair from the given alternatives.
TOM : NIG :: ? : ?
(a) EAT : YUN   (b) EAT : XXM
(c) FAT : LMV   (d) EAT : ZXC

Ans : (a)
Just as

So, $? \Rightarrow$ EAT : YUN

105. In the following question, select the related letters from the given alternatives.
LERI : PJVN :: MONT : ?
(a) WRTY   (b) QTRY
(c) RITY   (d) RQYB

Ans : (b)
Just as

Similarly

So, $? \Rightarrow$ QTRY

106. In the following question, select the related letters from the given alternatives.
SAT : WEX :: MET : ?
(a) AQI   (b) IYX
(c) FHY   (d) QIX

Ans : (d)
Just as

Similarly

So, $? \Rightarrow$ QIX

107. In the following question, select the related number from the given alternatives.

43 : 7 :: 23 : ?

(a) 6   (b) 4
(c) 7   (d) 5

Ans : (d)
Just as $43 \Rightarrow 4 + 3 = 7$
Similarly $23 \Rightarrow 2 + 3 = 5$
So, the number from the given alternatives is 5.

108. In the following question, select the related number from the given alternatives.

38 : 53 :: 53 : ?

(a) 72   (b) 68
(c) 79   (d) 87

Ans : (b)
Just as

So, $? \Rightarrow 68$

Note– The number of the second group is obtain by adding 15 in the first group number.

109. In the following question, select the related number from the given alternatives.

9 : 81 :: 11 : ?

(a) 78   (b) 93
(c) 121   (d) 146

Ans : (c)
Just as $(9)^2 = 81$
Similarly $(11)^2 = 121$
Note– The number of the second group is obtain by square the first group number.
So the number is 121

110. In the following question, select the odd word from the given alternatives.

(a) Goggle   (b) Purse
(c) Accessories   (d) Belt

Ans : (c) Goggle, purse and belt are all come under the accessories. So, accessories is the odd word from the given alternatives.

111. In the following question, select the odd word from the given alternatives.

(a) Grapes   (b) Guava
(c) Cauliflower   (d) Orange

Ans : (c) Grapes, guava and orange are the types of fruits and cauliflower is the type of vegetable. So, cauliflower is the odd word from the given alternatives.

112. In the following question, select the odd word from the given alternatives.

(a) Sparrow   (b) Rat
(c) Ostrich   (d) Parrot

Ans : (b) Sparrow, ostrich and parrot are the types of birds where as the rat are the mammals. So, rat is the word which different from given alternatives.

113. In the following question, select the odd letters from the given alternatives.

(a) GCXTO   (b) KGBXS
(c) RNIEX   (d) QMHDY

Ans : (c)

So, the option (c) is different from given

114. In the following question, select the odd letters from the given alternatives.

(a) SOKG   (b) AWSO
(c) RNJF   (d) CYTP

Ans : (d)

So, the option (d) is the odd from the given alternatives.

115. In the following question, select the odd letters from the given alternatives.

(a) KNQ   (b) DGJ
(c) WZB   (d) TWZ

Ans : (c)

So, the option (d) is different from the given alternatives.

116. In the following question, select the odd number from the given alternatives.
(a) 7–11
(b) 12–16
(c) 14–18
(d) 9–15

Ans : (d)

$$7 \longrightarrow 11 \qquad 12 \longrightarrow 16$$
(a) └────┘   (b) └────┘
      +4   +4

$$14 \longrightarrow 18 \qquad 9 \longrightarrow 15$$
(c) └────┘   (d) └────┘
      +4   +6

So, the option (d) is different from the given alternative.

117. In the following question, select the odd number from the given alternative.
(a) 2–4
(b) 3–9
(c) 4–18
(d) 5–25

Ans : (c)
(a) $2^2 = 4$
(b) $3^2 = 9$
(c) $4^2 \neq 18$
(d) $(5)^2 = 25$

The square of 4 is equal to 16 but in the given option is equal 18. So, option (c) is the odd number from given alternatives.

118. In the following question, select the odd number pair from the given alternatives.
(a) 76–42
(b) 92–20
(c) 73–21
(d) 93–27

Ans : (b)
(a) $76 - 42 \Rightarrow 7 \times 6 = 42$
(b) $92 - 20 = 9 \times 2 = 18 \neq 20$
(c) $73 - 21 = 7 \times 3 = 21$
(d) $93 - 27 = 9 \times 3 = 27$

So, the option (b) is different from the given alternatives.

119. Arrange the given words in the sequence in which they occur in the dictionary.
(1) **Flagrant**
(2) **Flavour**
(3) **Flatter**
(4) **Flick**
(5) **Flawed**
(a) 13254
(b) 31254
(c) 23541
(d) 32541

Ans : (a) Arrangement of the words according to the sequence in the dictionary are–
(i) Flagrant
(ii) Flatter
(iii) Flavour
(iv) Flawed
(v) Flick

120. According to dictionary, which of the following word will come at THIRD position?
(1) **Heritage**
(2) **Helpful**
(3) **Hectic**
(4) **Heroic**
(5) **Heroism**
(a) Hectic
(b) Heritage
(c) Heroic
(d) Helpful

Ans : (b) Arrangement of words according to dictionary are–
- Hectic
- Helpful
- Heritage   – 3rd position
- Heroic
- Heroism

So, the word 'Heritage' will come at third position.

121. From the given alternatives, according to dictionary, which word will come at LAST position?
(a) Juvenile
(b) Justify
(c) Judge
(d) Justice

Ans : (a) Arrangement of words according to dictionary are–
- Judge
- Justice
- Justify
- Juvenile   –Last position

So, the word 'Juvenile' will come at last position.

122. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
F, M, T, ?, H, O
(a) B
(b) C
(c) A
(d) D

Ans : (c)

$$\begin{array}{cccccc} 6 & 13 & 20 & 1/27 & 8 & 15 \\ F & M & T & \boxed{A} & H & O \end{array}$$
└──┘└──┘└──┘└──┘└──┘
+7   +7   +7   +7   +7

Note– A = 1 or 1 + 26 = 27

123. A series is given with one term missing. Select the correct alternative from the given that will complete the series.
ROK, LIE, FCY, ZWS, ?
(a) LAQ
(b) SRV
(c) TQM
(d) FMQ

Ans : (c)

$$\begin{array}{c} \underset{R}{18} \xrightarrow{-6} \underset{L}{12} \xrightarrow{-6} \underset{F}{6} \xrightarrow{-6} \underset{Z}{26} \xrightarrow{-6} \boxed{\underset{T}{20}} \\ \underset{O}{15} \xrightarrow{-6} \underset{I}{9} \xrightarrow{-6} \underset{C}{3} \xrightarrow{-6} \underset{W}{23} \xrightarrow{-6} \boxed{\underset{Q}{17}} \\ \underset{K}{11} \xrightarrow{-6} \underset{E}{5} \xrightarrow{-6} \underset{Y}{25} \xrightarrow{-6} \underset{S}{19} \xrightarrow{-6} \boxed{\underset{M}{13}} \end{array}$$

So, TQM, are the correct alternatives from the given that will complete the series.

124. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
FAQ, LGW, RMC, ?, DYO
(a) VIR
(b) XSI
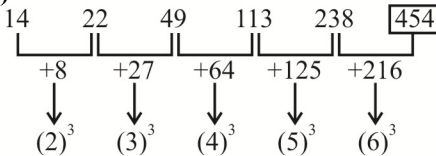(c) LSI
(d) MIS

Ans : (b)

So, XSI are the term which is complete the series.

125. **In the following question, select the missing number from the given alternatives.**
14, 22, 49, 113, 238, ?
(a) 386   (b) 532
(c) 454   (d) 576

Ans : (c)

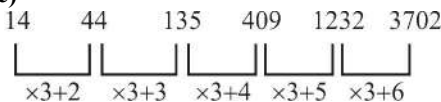

So, the missing number is 454 from the given alternatives.

126. **In the following question, select the missing number from the given alternatives.**
42, 21, 21, 31.5, 63, ?
(a) 169.75   (b) 157.5
(c) 152.5   (d) 126.75

Ans : (b)

$$42 \times \frac{1}{2} = 21, \qquad 21 \times \frac{2}{2} = 21,$$

$$21 \times \frac{3}{2} = 31.5, \qquad 31.5 \times \frac{4}{2} = 63,$$

$$63 \times \frac{5}{2} = 157.5$$

So, the missing number is 157.5 from the given alternatives.

127. **In the following question, select the missing number from the given alternatives.**
14, 44, 135, 409, 1232, ?
(a) 2962   (b) 3340
(c) 3702   (d) 3406

Ans : (c)

So, 3702 is the missing number from the given alternatives.

128. **E is sitting between D and A, B is to the right of A, C is at one of the ends and C and D are sitting next to each other. Who is sitting third?**
(a) D   (b) A
(c) B   (d) E

Ans : (d) The arrangement of sitting according to question

So E is sitting at the third position.

129. **Showing a photograph of a married couple B said that the gentleman in it was his father's father and A said that the lady in it was her mother. How is A related to B?**
(a) A is B's mother's sister
(b) A is B's sister
(c) A is B's Father's sister
(d) A is B's mother

Ans : (c)
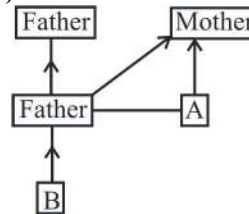
So, A is B's father's sister.
Note– The gender of A is not given in question but according to option A is B's father's sister.

130. **From the given alternative words select the word which cannot be formed using the letters of the given word.**
MERCANTILE
(a) truce   (b) learn
(c) trace   (d) claim

Ans : (a) Truce is the word which cannot be formed by using the letters of MERCANTILE because the letter. U is not present in the given word.
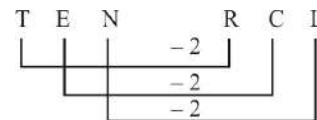
131. **If OLYMPUS is coded as MJWKNSQ, then how will TEN be coded as?**
(a) RCL   (b) GVM
(c) SDM   (d) UFO

Ans : (a)
Just as
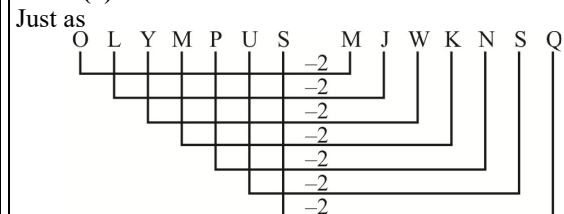
Similarly

So, the TEN be coded as RCL.

132. **In a certain code language, 1875 means 'wound the round watch', 1643 means 'a cake is round' and 7321 means 'watch a round wheel'. Find the code for 'watch'.**
(a) 1   (b) 8
(c) 5   (d) 7

Ans : (d)

1 8 7 5   wound the round watch   .... (i)

1 6 4 3   a cake is round   .... (ii)

7 3 2 1   watch a round wheel   .... (iii)

In the equation (i) and (iii) the watch and 7 are exist due this it is clean that the code for ['watch' = 7]

133. In a certain code language, '+' represents '–', '–' represents '×', '×' represents '÷' and '÷' represents '+'. Find out the answer to the following question.

96 × 4 ÷ 125 + 25 – 5 = ?
(a) 23   (b) 24
(c) 50   (d) 8

Ans : (b)
$+ = –, – = ×, × = ÷, ÷ = +$
$96 × 4 ÷ 125 + 25 – 5 = $ Equation
According to question by changing the mathematical expression and solving the equation.
⇒ $96 ÷ 4 + 125 – 25 × 5$
⇒ $24 + 125 – 125$
⇒ $149 – 125$
⇒ 24
So, the answer of the given equation is 24.

134. If 17 $ 22 = 4 and 56 $ 13 = 7, then find the value of 71 $ 25 = ?
(a) 56   (b) 96
(c) 1   (d) 8

Ans : (c) Just as
17 $ 22 = 4
⇒ $(1+7) – (2 + 2)$
⇒ $8 – 4 = 4$
And   56 $ 13 = 7
$(5 + 6) – (1 + 3)$
$11 – 4 = 7$
Similarly   71 $ 25
⇒ $(7 + 1) – (2 + 5)$
⇒ $8 – 7 = 1$
So, the value of 71 $ 25 = 1

135. If A $ B means A is son of B, A # B means A is brother of B and If A * B means A is father of B, then what does X # Y * Z $ W mean?
(a) W is X's brother's wife
(b) W is X's wife
(c) W is X's mother
(d) W is X's sister

Ans : (a)
A $ B → A is son of B
A # B → A is brother of B
A * B → A is father of B
x ≠ y * z $ w .... equation
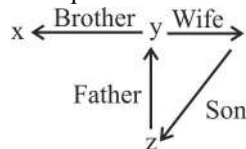
So, W is X's brother's wife

136. Select the missing number from the given responses:

1	4	2
2	7	10
3	?	12

(a) 3   (b) 9
(c) –3   (d) 11

Ans : (d)
From the first column
$1 + 2 = 3$
From the second column
$4 + 7 = \boxed{11}$
And, from the third column
$2 + 10 = 12$
So, the missing number is 11 from the given responses.

137. Which of the following terms follows the trend of the given list?
OOXXXXX,   OXOXXXX,   OXXOXXX, OXXXOXX, OXXXXOX, ...
(a) XOXXXXO   (b) XOXXXOX
(c) OXXXOXX   (d) OXXXXXO

Ans : (d) The term OXXXXXO is follows the trend of the given list. The second place O will shifted from left to right in each next terms.


So.   ? = OXXXXXO

138. A scientist is studying the behavior of an ant. The ant picks food and walks 5 cm North, then it turns to its right and walks for another 11 cm. Then it turns right and walks 3 cm, then it turns West and walks 15 cm, then finally it turns to its left and walks 2 cm. Where is the ant now with respect to its starting point?
(a) 4 cm East   (b) 26 cm West
(c) 4 cm West   (d) 26 cm East

Ans : (c)

So, 4 cm west is the Ant now with respect to its starting point.
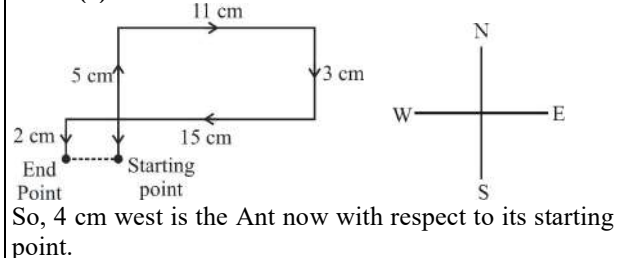
139. Two football players start running from the same point on the ground. Player A runs 10 km East, then turns to his left and runs 13 km. In the meanwhile Player B runs 6 km South, then he runs 3 km East, the he turns to his left and runs 19 km. Where is Player A with respect to Player B?
(a) 7 km West   (b) 7 km East
(c) 13 km East   (d) 13 km West

Ans : (b)
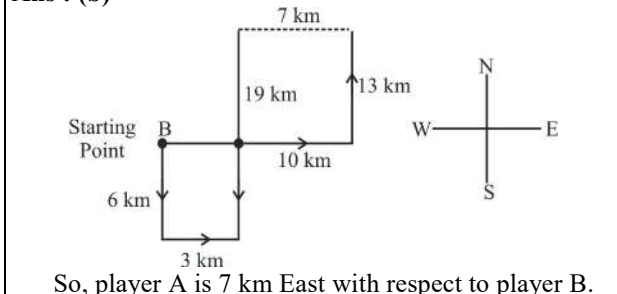
So, player A is 7 km East with respect to player B.

140. In the question two statements are given, followed by two conclusions, I and II. You have to consider the statements to be true even if it seems to be at variance from commonly known facts. You have to decided which of the given conclusions, if any, follows from the given statements.

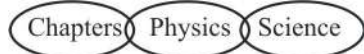Statement I : Some chapters are physics.
Statement II : All science is physics.
Conclusion I : All science is chapters
Conclusion II : Some physics is science
(a) Only conclusion I follows
(b) Only conclusion II follows
(c) Both conclusions I and II follow
(d) Neither conclusion I nor conclusion II follows

Ans : (b)

Conclusion I : All science is chapter   (×)
Conclusion II : Some physics is science   (√)
So, only conclusion II is follows.

141. In the question three statements are given, followed by three conclusions, I, II and III. You have to consider the statements to be true even if it seems to be at variance from commonly known facts. You have to decided which of the given conclusions, if any, follows from the given statements.

Statement I : All success is victory
Statement II : All luck is success
Statement III : Some hard work is luck
Conclusion I : Some success is hard work
Conclusion II : Some hard work is victory
Conclusion III : No victory is luck
(a) Only conclusions I and II follows
(b) Only conclusions II and III follows
(c) Only conclusions I and III follow
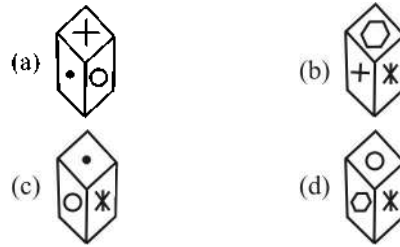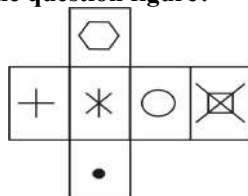(d) All conclusions I, II and III follow

Ans : (a)

Conclusion I : Some success is hard work   (√)
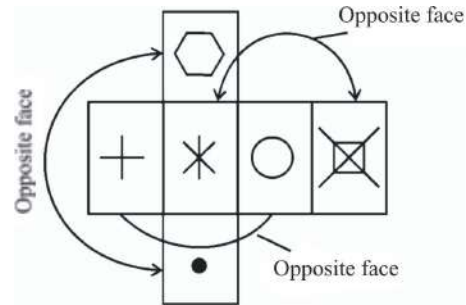Conclusion II : Some hard work is victory   (√)
Conclusion III : No victory is luck   (×)
So, only conclusion I and II follows.

142. Which of the following cube in the answer figure cannot be made based on the unfolded cube in the question figure?
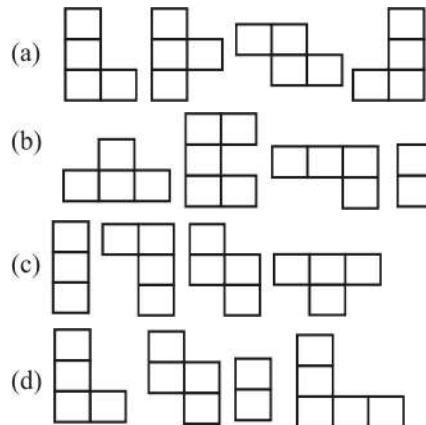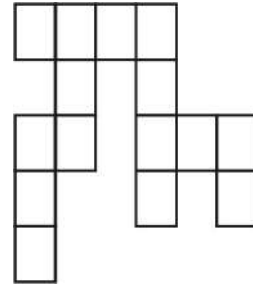

Ans : (a)

The cube in option (a) in the answer figure cannot be made based on the unfolded cube in the question figure. In option (a) + and O are shown in a cube, but in question figure it will gives equal end opposite site.

143. Which of the following answer figure patterns can be combined to make the question figure?

Ans : (b) The answer figure patterns (b) can be combined to make the question figure.

144. In the following figure, square represents professors, triangle represents Social Workers, circle represents Dieticians and rectangle represents Men. Which set of letters represents Dieticians who are not men?

(a) EFGI   (b) BDKHJ
(c) IGAC   (d) DEJI

Ans : (a)

So, the set of letters EFGI represents dieticians who are not men.

145. Which of the following Venn diagrams represents the relationship between Butterflies, Animals and Insects?

Ans : (a)

146. Which answer figure will complete the pattern in the question figure?

Ans : (c) The pattern in the question figure is completed by the answer figure (c).

147. From the given answer figures, select the one in which the question figure is hidden/embedded.

Ans : (c) The question figure is hidden/embedded in the answer figure (c).

148. A piece of paper is folded and punched as shown below in the question figures. From the given answer figures, indicate how it will appear when opened.

Ans : (c) According to the question when a piece of paper is folded and punched and then open it will appear as answer figure (c).

149. If a mirror is placed on the line MN, then which of the answer figures is the right image of the given figure?

Ans : (d) If a mirror is placed on the line MN then the answer figures of option (d) is right image of the given figure.

150. **A word is represented by only set of numbers as given in any one of the alternatives. The sets of numbers given in the alternatives are represented by two classes of alphabets as shown in the given two matrices. The columns and rows of Matrix-I are numbered from 0 to 4 and that of Matrix-II are numbered from 5 to 9. A letter from these matrices can be represented first by its row and next by its column, for example 'C' can be represented by 43, 41 etc and 'O' can be represented by 97, 78 etc. Similarly, you have to identify the set for the word 'SPAN'.**

Matrix-I आव्यूह-I					
	0	**1**	**2**	**3**	**4**
0	M	M	M	1	E
1	A	M	J	1	A
2	F	I	M	1	E
3	I	J	A	L	K
4	D	C	A	C	L

Matrix-II आव्यूह-II					
	5	**6**	**7**	**8**	**9**
5	N	V	Q	U	S
6	R	S	T	U	N
7	S	Z	X	O	V
8	X	S	P	W	P
9	U	X	O	Y	Y

(a) 66, 87, 33, 56   (b) 59, 78, 42, 31
(c) 86, 89, 32, 55   (d) 78, 43, 22, 98

Ans : (c)
(a) 66   87   33   56
     S   P   L   V   – wrong
(b) 59   78   42   31
     S   O   A   J   – wrong
(c) 86   89   32   55
     S   P   A   N   – Right
(d) 78   43   22   98
     O   C   M   Y   – wrong

So, the SPAN is represented by the set of number i.e. 86,89,32,55.

General Knowledge

151. **Preliminary expenses are the examples of…………**
    (a) Capital expenditure
    (b) Capital gain
    (c) revenue expenditure
    (d) deferred revenue expenditure

Ans. (a) : Capital expenditure is the example of preliminary expenses. Capital expenditures are those governmental expenditure, which is helpful in making the physical and financial assets. These expenditures includes the building construction, dams, Railways,

Industrial development etc. It is done irregularly. It is called the developmental expenditure. In the budget document, the gross capital expenditure has been divided into two categories–(1) Non-planned capital expenditure, (2) Planned capital expenditure.

152. **Which economic activity cannot be included in the tertiary sector?**
    (a) Working in a call-centre
    (b) Tuition occupation
    (c) Bee-keeping
    (d) Banking

Ans. (c) : In economy, the economic sectors has been divided into three parts–
(1) Primary sector–These includes agriculture, forestry, animal husbandry, fisheries, Bee keeping, mining and quarrying.
(2) Secondary sector–These includes industries like sugar, textiles etc. and the manufacturing.
(3) Tertiary sector–This is basically called the service sector. This includes mainly banking, insurance, transport, telecom, tuition occupation, working in the call centre etc. Hence the option (c) the Bee-keeping falls under primary sector.

153. **Which of the following statement is true for the Public Sector Unit?**
    (a) Most of assets is owned by a group of people
    (b) Most of assets is owned by big companies
    (c) Most of assets is owned by government
    (d) Most of assets is owned by an individual

Ans. (c) : Public sector units includes all those industrial and commercial enterprises which is owned and managed by the government or by any other agency assigned by the government. Hence the assets of public sector units are mostly in government ownership. The public sector provides basic facilities like defence, energy, iron and steel, coal, journey by air etc. It is remarkable that Pandit Jawahar Lal Nehru named the public sectors as the 'temples of modern India'.

154. **The percentage of India's population in the total population of the world as per 2011 census is:…………**
    (a) 17.5%   (b) 18.01%
    (c) 19.35%   (d) 20.25%

Ans. (a) : According to the census of 2011 the total population of India is 121.5 crore which is 17.5% of world's total population. In India, states with higher population are – U.P., Maharashtra, Bihar, West Bengal, Andhra Pradesh.

155. **Which of the following five year plan of India recognized human development as the core of development efforts?**
    (a) Eighth five year plan
    (b) Ninth five year plan
    (c) Tenth five year plan
    (d) Eleventh five year plan

Ans. (a) : Eighth five year plan (1992-97) was based on the John W. Muller model of influence in the form of

emphasis on infrastructure. In this plan the human resource development was the essence of all developmental efforts and the theme was 'Development of human resource'. It is important that India became a member of the W.T.O. on 1st January 1995 during this plan.

156. Which of the following thinker is associated with "the concept of political sovereignty?
(a) MacIver   (b) Socrates
(c) Rousseau   (d) Plato

Ans. (c) : Rousseau was a great philosopher and thinker, who was born on 1712 A.D. in Geneva. Rousseau is associated with "the concept of political sovereignty" Rousseau says that "Man is born free, and every where he is in chains." Rousseau's famous compositions are – (i) The Social Contract, 1762, (2) Dialogue, (3) An Introduction to Political Economy, 1758

157. Who said, "A good citizen makes a good state and a bad citizen makes a bad state"?
(a) Plato   (b) Aristotle
(c) G. B. Shaw   (d) Rousseau

Ans. (b) : Aristotle's statement was that "A good citizen makes a good state and a bad citizen makes a bad state." It is important that Aristotle was a famous Greek Philosopher, a pupil of Plato and the teacher of Alexander the great. Their greatest composition is 'Politics'. Aristotle has considered the family as a natural body.

158. Panchayat Samiti at the block level in India is a/an………….
(a) Advisory Body
(b) Coordinating Authority only
(c) Supervisory Authority only
(d) Administrative Authority

Ans. (d) : In India the Panchayati Raj system has three levels – Gram Panchayat at village level, Panchayat Samiti at Block level and Zila Parishad at District level. The Panchayat Samiti at Block level is an administrative authority. It has power of functioning of all developmental works in their respective areas. It can function the works related to education, health, agriculture and village industries.

159. According to Indian Constitution, who decides the Salary of members of Parliament?
(a) Unions Council of Ministers
(b) Parliament
(c) Supreme Court
(d) President of India

Ans. (b) : According to article 106, of Indian Constitution the parliament will decide the salary and allowances of every members of parliament. It is important that to be elected as a member of parliament one must be – a citizen of India. For the membership of Rajya Sabha age must not be less than 30 years and 25 years in the case of Lok Sabha.

160. Which one of the following is not correctly matched?
(a) Eighth Schedule: Languages
(b) Second Schedule: Form of Oath of office
(c) Fourth Schedule: Allocation of seats in Raiya Sabha
(d) Tenth Schedule: Defection related provisions

Ans. (b) :

Schedule	Related Subjects
(1) 8th Schedule	Languages
(2) 2nd Schedule	Provisions relating to President, Governor, Speaker and Deputy Speaker of Lok Sabha, Chairman and Deputy Chairman of Rajya Sabha, Judges of Super Court and high Court etc.
(3) 4th Schedule	Allocations of seat in the Rajya Sabha
(4) 10th Schedule	Anti-defection law.

Note – Form of Oaths or Affirmation has been described in 3rd Schedule.

161. When did the Chinese traveler 'Sung Yun' come to India?
(a) 510 AD   (b) 518 AD
(c) 525 AD   (d) 528 AD

Ans. (b) : Chinese traveler 'Sung Yun' came to India in 518 A.D. and collects many Buddhist text during their three year stay.
It is noted that Fa-hien, Hsuan Tsang and I-tsing were other chinese traveler who visited India. Fa-hien came in the reign of chandra gupta II Vikrmaditya (375-415 A.D.). Hsuan Tsang came in the reign of Harshvardhan in around 629 A.D.

162. Which among the following state 'Odantpuri' education center was situated?
(a) Bengal   (b) Gujarat
(c) Bihar   (d) Tamil Nadu

Ans. (c) : "Odantpuri" education center was situated in Bihar. According to some scholar the famous Budhist monastery of Odantpuri (Bihar) was built by Devapala who was a follower of Buddhism. In texts he adorned of 'Paramsaugat'.

163. Who was the founder of Bahmani Kingdom?
(a) Hasan Gangu   (b) Firoz Shah
(c) Mahmud Gawan   (d) Asaf Khan

Ans. (a) : In Deccan (South India), the Bahmani kingdom had come into existence in 1347, the later period of Muhammad Bin Tughlaq, by an Afghan adventurer Gangu who assumed the title of Alauddin Hasan Bahaman Shah. He made Gulburga the capital of newly established empire and renamed it Ahsanabad – Later in 1425 Bidar became its capital.

164. During whose rule in India did the Khilafat movement begin?
(a) Lord Mountbatten   (b) Lord Dalhousie
(c) Lord Chelmsford   (d) Lord Curzon

Ans. (c) : Khilafat and non-cooperation movement has started in the period of Lord Chelmsford (1916-21 A.D.). The other events in this period are–(i) Rowlett act of 1919, (ii) Jaliyanwala bagh massacre in 13th April, 1919, (3) Sadler Commission in 1917 to enquire about Calcutta University.

165. **Who among the following was the founder of the Arya Mahila Samaj in the early 1880s?**
    (a) Swami Dayananda Saraswati
    (b) Swami Vivekananda
    (c) Ramabai Ranade
    (d) Pandita Ramabai

Ans. (d) : Arya Mahila Samaj was established by Pandita Ramabai in 1881 in Pune. In 1889 Ramabai established Sharda Sadan for widows. Pandita Ramabai was a famous social worker as well as a great scholar. She traslated Bible into Marathi.

166. **Dasht-e Kavir Desert is located in which country?**
    (a) Iran   (b) Saudi Arab
    (c) Iraq   (d) Sudan

Ans. (a) : Dasht-e Kavir and Dasht-e Lut both desert are situated in Iran. Iran is a country in west Asia. The highest peak of Iran is Mount Demavand which is situated in Elburz mountains. It is important that in Iran the major irrigation portion is covered by the Qanat canal which is made by under ground tunnels.

167. **Which of the following layers is called "Barysphere"?**
    (a) Earth's most internal layer
    (b) Earth's intermediate layer
    (c) Earth's topmost layer
    (d) Lowest part of the atmosphere where climate changes occur

Ans. (a) : On the basis of seismic waves the earth's layer has been divided into three parts–
(i) Lithosphere– This is upper most part of earth's surface which is also called Sial. Its thickness is observed of around 100Km.
(ii) Pyrosphere– This layer is also called the mag mosphere. It contains excess of basalt. Its thickness is upto 2880 Km.
(iii) Barysphere– This is the innermost part of Earth's surface. In this layer the excess of Iron and Nickel occurs. This is situated beyond 2880 Km.

168. **The Blue Nile river originates from which of the following lakes?**
    (a) Lake Victoria   (b) Lake Tana
    (c) Lake Edward   (d) Lake Albert

Ans. (b) : Lake Tana of Ethiopia, a country in African continent, is the largest in the country. The Blue Nile river originates from it while the Nile river originates from Victoria lake, the largest lake in Africa continent. Nile river is the longest in the world.

169. **Which of the following states of India has the largest percentage of geographical area under forest as per the report of the Forest survey of India?**
    (a) Manipur   (b) Meghalaya
    (c) Mizoram   (d) Nagaland

Ans. (c) : India's forest survey report (IFSR) 2017 has published on 12th Feb, 2017. According to this report the state with highest percentage cover of forest are– Lakshadeep - 90.33%, Mizoram - 86.27%, Andaman & Nicobar Island - 81.73%
Note–According to options available in the question the option (c) is correct.

170. **At which of the following towns the Alaknanda and the Bhagirathi combines to form River Ganga?**
    (a) Haridwar   (b) Rishikesh
    (c) Rudraprayag   (d) Devprayag

Ans. (d) : Alaknanda and the Bhagirathi combines near Devprayag of Uttarakhand to form the river Ganga. Ganga river originates from the Gangotri glacier of Uttarakhand. Yamuna is the right tributaries of Ganga while the major left tributaries are–Ramganga, Gomti, Ghaghra, Gandak, Kosi and Mahananda. It is important that the delta of Ganga and Brahmaputra is the largest in the world.

171. **'Nirvana Fund' was set up by NSDC for financial help to………….**
    (a) Entrepreneurs from the bottom rungs of society
    (b) Displaced Kashmiri Pundits
    (c) Old age people having no means of livelihood
    (d) Ventures of selected candidates trained under PMKVY but did not get any job

Ans. (d) : 'Nirvana Fund' was set up by NSDC for financial help to those unemployed candidate who is selected and skilled under PMKVY (Pradhanmantri Kaushal Vikas Yojna).

172. **'Nakul Swasthya Patra' is a scheme by the Government for which among the following purposes?**
    (a) Wellness of animals
    (b) Wellness of animal owners
    (c) Taking care of lactating mother in the rural areas
    (d) Taking care of newborn babies in the rural areas

Ans. (a) : 'Nakul Swasthya Patra' is an animal health card scheme started by Animal and dairy board of ministry of agriculture, Govt. of India. In this card the complete record about the breed of animal, age of herds man with their name and health of animal will be registered.

173. Which mine of India was in the news recently for becoming the country's first iron-ore mine to have a solar plant for reducing carbon footprint?
(a) Talchar mine   (b) Koraput mine
(c) Noamundi mine (d) Ratnagiri mine

Ans. (c) : On 10th July 2017 the Noamundi Mine of Tata Steel, Jamshedpur became the country's first iron-one mine to have a solar plant. Solar power plant of 3 MW has installed here which will reduce the carbon footprint of 3000 tons annually.

174. Where will the Summer Olympics be held in 2028?
(a) Sydney   (b) Paris
(c) Los Angeles (d) Copenhagen

Ans. (c) : Summer Olympics games 2020 will be held in Tokyo (Japan) while in 2024 and 2028 will be held in Paris (France) and Los Angles (USA) respectively.

175. Which country has won the 2017 Davis Cup Tennis Tournament?
(a) Switzerland (b) Serbia
(c) France   (d) Belarus

Ans. (c) : Davis Cup is the most reputed international team competition on Lawn Tennis in men's group. In 2017, France wins the tournament by defeating Belgium.

176. "You are Unique" is written by………..
(a) Dr. A.P.J. Abdul Kalam
(b) Khushwant Singh
(c) Taslima Nasrin
(d) Arvind Adiga

Ans. (a) : The book "You are unique" is written by Dr. A.P.J. Abdul Kalam.

177. The third Indian Council for Cultural Relations (ICCR) Distinguished Indologist Award for the year 2017 was awarded to Japanese professor…………
(a) Hiroshi Marui (b) Shimamaru Marui
(c) Nagasaki Marui (d) Toyota Marui

Ans. (a) : The third Indian Council for Cultural Relations (ICCR) Distinguished Indologist Award for the year 2017 was awarded to Japanese professor Hiroshi Marui. It is bestowed upon eminent Indologist working abroad who have made outstanding contribution to study, research, teaching of India's history, philosophy, thought, art, culture, literature languages, civilization, society etc.

178. Which of the following city has became first Indian city to get UNESCO's world heritage city tag?
(a) Jaipur   (b) Ahmadabad
(c) Gandhi Nagar (d) Allahabad

Ans. (b) : In 41st session of UNESCO's world heritage summit on 8th of July 2017, Ahmadabad, the historical city of Gujarat, got the world heritage city tag. This is the first city in India to have such title.

179. In June 2017, which of the following countries have signed a protocol of co-operation in the field of archive?
(a) India and Israel
(b) India and Portugal
(c) India and Netherland
(d) India and Iran

Ans. (b) : In June 2017 India and Portugal has signed a protocol of co-operation in the field of archive.

180. India has signed an agreement to provide USD 318 million as line of credit for developing railway sector of which of the following country?
(a) Bangladesh (b) Nepal
(c) China   (d) Sri Lanka

Ans. (d) : India has signed an agreement with Sri Lanka to provide USD 318 million as line of credit for developing railway sector.

181. Dot Matrix is a type of…………
(a) Tape   (b) Disk
(c) Printer   (d) Bus

Ans. (c) : Printer is an output device that receives information from computer and print on paper. This copy of the output on paper is called hard copy. Dot Matrix is a type of printer, it is an impact printer so it makes noise while printing. This printer has a matrix of multiple pins in the print hand and all dot matrix printers create characters on paper by striking an inked ribbon with a hard surface.

182. The secondary storage devices can only store data but they cannot perform………….
(a) Arithmetic operations
(b) Logic operations
(c) Fetch operations
(d) All options are correct

Ans. (d) : The secondary storage devices are also called Auxiliary storage devices. This is not a part of computer. It is connected to the computer separately. These devices can store data only, arithmetical, logical and fetching operations can't be done by this.

183. In the modern periodic table metals, metalloids and non metals are found in which block?
(a) s-Block   (b) p-block
(c) d-block   (d) f-block

Ans. (b) : On the basis of valancy electrons in modern periodic table the elements are divided into four blocks–s,p,d,f. s-block contains the elements of group 1 & 2. p-block contains elements of group 13 to 18 i.e. metal, non metal and sub metal. d-block contains elements of group 3 to 12 and f-block contains lanthanides and actinides elements.

184. Cinnabar is ore of which of the following?
(a) Magnesium (b) Aluminium
(c) Mercury   (d) Iron

Ans. (c) : Mercury is a chemical element with symbol Hg and atomic number 80. It is also called quick silver. It is very rare element in nature and found in independent state. Its main ore is Cinnabar. It is white in colour and very bright metal which is found in liquid state at room temperature. Like other metals it is neither malleable nor ductile. At 4.12k temperature its resistance becomes zero.

185. **In which of the following mirror size of image formed is always equal to the size of object?**
    (a) Convex mirror
    (b) Concave mirror
    (c) Plane mirror
    (d) Both convex and concave mirror

Ans. (c) : Plane mirror is made polishing the surface of a glass of uniform thickness with a bright metal like mercury and silver on one side. This process is called silvering. After this a layer of silver nitrate is applied which reflects the light rays striking on it. The size of image in the plane mirror is always equal to the size of the object. The plane mirror is utilised in the form of looking glass, Kaleidoscope and Periscope.

186. **Mass of a hydrogen atom is how many time the mass of an electron?**
    (a) 1000   (b) 8000
    (c) 1837   (d) 5000

Ans. (c) : Mass of a hydrogen atom is 1837 times mass of an electron. It is important that hydrogen is a gaseous non metal whose atomic number is 1 and atomic weight is 1.008. It is also called the first element of periodic table. It contains only one proton in their nucleus and an electron revolving outside of nucleolus. It is the only element with zero neutron. It is most available element in the universe.

187. **Which of the following are Fabrics that may contain polyester?**
    I. **Polycot**
    II. **Polywool**
    III. **Terrycot**
    (a) Only I and II   (b) Only I and III
    (c) Only II and III   (d) All I, II and III

Ans. (d) : Polyester is a polymerised synthetic fiber. In order to synthesis the polyester hydroxyl (–OH) groups carbonous compound chemically react with two carboxylic (–COOH) groups and ester group (–COO) is formed. Since in this fiber there are so many ester groups thus it is called polyester. It is used in the form of cloths, in making housepipes of fire extinguishers. Polycot, polywood and Terrycot clothe can have polyester.

188. **Which of the following term does NOT represent electrical power in circuit?**
    (a) I^2R (b) IR^2
    (c) VI   (d) V^2/R

Ans. (b) : Electrical circuit is a combination of various electrical appliances and instruments in which electrical energy generated by the blowing of current can be used for various purposes.
As we know that – P = VI ---------- (1)
where
    I = current, R = Resistance, V = Potential
    P = Electrical power
but according to ohm's law – V = IR --------- (2)
By putting the value of equation. (2) in equation (1)

$$P = \frac{V^2}{R}$$

    $\because$ P = I^2R --------- (3)
then by putting value of equ. (2) in equation (3)

$$I = \frac{V}{R} \quad -------- (4)$$

then equ. $\Rightarrow$ $P = \dfrac{V^2}{R}$

while option (b) IR^2 is not correct.

189. **A positively charged particle projected towards west is deflected towards north by a magnetic field. What is the direction of magnetic field?**
    (a) toward south   (b) toward east
    (c) downward   (d) upward

Ans. (d) : The region or space around a magnet through which any other magnet or magnetic material experience force of attraction or repulsion is called magnetic field. SI unit of magnetic field is Tesla (T). A positively charged particle projected towards west is deflected towards north by a magnetic field then direction of magnetic field will be upward.

190. **Which of the following is NOT positively charged?**
    (a) Alpha particle
    (b) Proton
    (c) Helium nucleus
    (d) Electron

Ans. (d) : Electron was invented by J.J. Thomson. It is a negatively charged particle which rotates in various orbits around the nucleus. The charge of an electron is – 1.6×10^{-19}C. This is a stable fundamental particle. While alpha particle, proton and Helium are positively charged.

191. **Which is a water soluble Vitamin?**
    (a) Vitamin A   (b) Vitamin C
    (c) Vitamin D   (d) Vitamin K

Ans. (b) : Vitamin–B and Vitamin–C are soluble in water while Vitamin – A, D, E, K are soluble in fat. It is important that Vitamin–C (Ascorbic acid) was first discovered. The deficiency of Vitamin–C causes scurvy disease. The main sources of Vitamin–C are citrus fruits like – lemon, orange, Indian gross berry etc.

192. Match the items given in column (A) with those in column (B).

Column-A	Column-B
I. Frog	1. Skin
II. Leaves	2. Stomata
III. Earthworm	3. Lungs and skin

(a) I-3, II-2, III-1   (b) I-1, II-2, III-3
(c) I-3, II-1, III-2   (d) I-2, II-1, III-3

Ans. (a) : Frogs respire through their lungs and skin. In the plants, the stomata's present in the leaves are responsible for the respiration while earthworm respires through their skin because it lacks lungs.
Hence option (a) is correct.

193. How many number of chambers are there in human heart?

(a) Two   (b) Three
(c) Four   (d) Five

Ans. (c) : There are four chambers in the human heart. Which are divided by septum to each other. The two upper chambers are small and thin called Auricle. The two lower chambers are called ventricle which are also of two types right ventricle and left ventricle. There is a hole between every auricle and their respective below ventricle which is called Atrio–ventricle valve. These valve open towards ventricle only.

194. Which of the following is NOT present in a matured stomata?

(a) Plasmodesma   (b) Chloroplast
(c) Cell wall   (d) Vacuole

Ans. (a) : Stomata is a hole found mainly in the epidermis of leaves. In matured stomata chloroplast, cell wall and vacuole are presents. The main function of stomata is to absorb carbon dioxide from the environment and to release oxygen that means the exchanges of gases. (Photosynthesis).

195. What is/are the cause(s) of arise hypermetropia?

(a) Excessive curvature of the eye lens.
(b) Elongation of the eye ball.
(c) Focal length of the eye lens is too long.
(d) No option is correct.

Ans. (c) : The causes of Hypermetropia are–
  (i) The sphericity of the eye lens is decreased.
  (ii) The focal length of the lens increases.
  (iii) Due to this the distance between eye lens and retina decreases that means the diameter of the eyeball is reduced.
The person suffering from hypermetropia can't see the near most objects but can see the objects located at remote distances.

196. Antibiotics are useful for which type of infections?

(a) Only bacteria
(b) Only virus
(c) Both bacteria and virus
(d) Neither bacteria nor virus

Ans. (a) : Antibiotics are also known as antimicrobial drugs. Antibiotics are used to treat or prevent infections caused by bacteria, fungi and protozoa. These medicines treat infections either by killing or decreasing the growth of bacteria. Naturally it is produced by some microorganism or artificially in the laboratory. It is important that penicillin, an antibiotic produced by the fungus, was discovered by Alexander Fleming.

197. Which one of the following is NOT responsible for water shortage?

(a) Rapid growth of industries
(b) Increasing population
(c) Forestation
(d) Mismanagement of water resources

Ans. (c) : When in a certain period the demand of water exceeds to their availability or the use of water is interrupted due to poor quality then this situation represents the scarcity of water. The reason behind this is–rapid industrialisation, growing population, mismanagement of water resources.

198. Which gas is major contributor to greenhouse effect?

(a) Carbon dioxide   (b) Chlorofluorocarbon
(c) Sulphur dioxide   (d) Nitrogen dioxide

Ans. (a) : The major responsible gases for green house effects are – carbon dioxide (CO_2), chlorofluorocarbon (CFC), Methane (CH_4), Nitrous oxide etc. These gases stops heat escaping from the earth into space which results in the increase of average temperature of atmosphere. Carbon dioxide has highest contribution in green house effect.

199. Which of the following is NOT a major problem in development of resources?

(a) Depletion of resources for satisfying the greed of few individuals.
(b) Accumulation of resources in few hands.
(c) An equitable distribution of resources.
(d) Indiscriminate exploitation of resources.

Ans. (c) : A resource is defined as a service or other asset used to produce goods and service of or have technology to produce that meet human needs and wants, and which is economically feasible and culturally valid. The main problems in development of resources are–
  (i) Degradation of resources by some greedy people
  (ii) Centralisation of resources to limited hands.
  (iii) Over exploitation of resources.

200. Which of the following is NOT manmade ecosystem?

(a) Orchards   (b) Home aquarium
(c) Botanical gardens   (d) Grassland

Ans. (d) : Human changes their natural environment for more and more production of things of their need like food, goods, medicine and many other useful products. Consequently new ecosystem forms in which human involves enough. Such type of ecosystem is called man made ecosystem. Examples are–Orchards, Home aquarium, botanical gardens etc. Grassland is a natural ecosystem.

Technical : Electrical

1. **Which one of the following has the ability to store energy in the form of electric charge?**
  (a) Superconductor   (b) Resistor
  (c) Capacitor   (d) Inductor

Ans : (c) Capacitor has the ability to store energy in the form of electric charge. It is a passive electronic component with two terminals. It stores energy in electric field. The effect of a capacitor is known as capacitance

Capacitor, $C = \dfrac{Q}{V}$

Where Q = positive or negative charge
       V = Voltage

2. **Which one of the following has the least number of free electrons in it?**
  (a) Conductors   (b) Semiconductor
  (c) Superconductor   (d) Insulators

Ans : (d) Insulators have the least number of free electrons in it because the energy band gap between valence band and conduction band is large in insulators. Whereas the value of energy band gap is less in conductors, resistivity of insulators lies between 10^{12} to 10^{20} ohm meter.
Conductivity of metal is of the order of $10^7 \ (\Omega\text{-m})^{-1}$
Conductivity of semiconductor range from 10^{-6} to 10^4 $(\Omega\text{-m})^{-1}$
The conductivity of insulators ranges between 10^{-10} to $10^{-20} (\Omega\text{-m})^{-1}$

3. **Watt is the S.I. unit of ....**
  (a) Current   (b) Voltage
  (c) Power   (d) Resistance

Ans : (c) Watt is the S.I. unit of power. The watt unit is named after James watt, the inventor of the steam engine, one watt is defined as the energy consumption rate of one joule per second.

$$1 \text{ Watt} = \frac{1 \text{ Joule}}{1 \text{ Second}}$$

One watt is also defined as the current flow of one ampere with voltage of one volt.

4. **Which of the following is the correct expression for the electrical power?**

  (a) VR   (b) $\dfrac{V}{R}$

  (c) V^2R (d) $\dfrac{V^2}{R}$

Ans : (d) DC Power- The correct expression for the electrical power is $P = \dfrac{V^2}{R}$

we know that $P = V.I$ where $V = IR$

so, $I = \dfrac{V}{R}$

$P = \dfrac{V.V}{R}$

$$\boxed{P = \frac{V^2}{R}}$$

Power is a multiplication of voltage and current for DC circuits $\boxed{P = VI}$

Whereas for AC circuit, power

for single phase $\boxed{P = V.I \cos\phi}$

AC-Power- The AC Power is mainly classified into three types. They are the apparent power, active power and real power.

1. Apparent Power- It is represented by the symbol S, and their SI unit is volt-amp.

$\boxed{S = V_{rms} I_{rms}}$

Where S= apparent power

V_{rms} = RMS voltage = $\dfrac{V_{peak}}{\sqrt{2}}$ in volt

I_{rms} = RMS current = $\dfrac{I_{peak}}{\sqrt{2}}$ in amp.

2. Active Power- It is real power which is dissipated in the circuit resistance.

$$\boxed{P = V_{rms} \ I_{rms} \ \cos\phi}$$

Where ϕ = Impedance phase angle between voltage and current.
       P = Real power in watts.

3. Reactive Power-It power developed in the circuit reactance is called reactive power (S).
It is measured in volt-ampere reactive.

$$\boxed{Q = V_{rms} I_{rms} \ \sin\phi}$$

Relation between P,Q, and S-

$$\boxed{S^2 = Q^2 + P^2}$$

The ratio of the real to the apparent power is called power factor and their value lies between 0 and 1.

5. What will be the resistance (in ohms) of a resistor, when the current through the resistor is 2 A and the potential difference between the ends of the resistor is 40 V?

(a) 20   (b) 10
(c) 30   (d) 40

Ans : (a) Given that,
Current (I) $= 2A$
Voltage (V) $= 40$ Volt
Resistance (R) $= \dfrac{V}{I}$
$R = \dfrac{40}{2} = 20\Omega$

6. What will be the cross-sectional area (in sq. m) of an 18 m long cylindrical wire when the resistivity of the wire is 0.67 ohm-meter and the resistance of the wire is 12 ohms?

(a) 2   (b) 3
(c) 1   (d) 6

Ans : (c) Length (ℓ) $= 18$ m
Area (A) = ?
Resistivity (ρ) $= 0.67$ Ω-m
Resistance (R) $= 12$ Ω
Resistance, $R = \rho \dfrac{\ell}{A}$,
Area (A) $= \dfrac{0.67 \times 18}{12} = 1.005$
Area (A) $= 1$ m^2

7. Determine the equivalent capacitance (in μF) of the given electrical network.
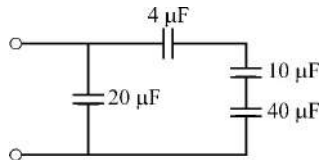
(a) 24.21   (b) 21.25
(c) 26.64   (d) 22.66

Ans : (d) Here 4μF, 10μF, 40μF are connected in series, so equivalent capacitance,
$\dfrac{1}{C_{eq}} = \dfrac{1}{10} + \dfrac{1}{4} + \dfrac{1}{40}$
$\dfrac{1}{C_{eq}} = \dfrac{4+10+1}{40}$
$C_{eq} = \dfrac{40}{15} = 2.66$ μF
again 2.66 μF and 20 μF are in parallel.
So, equivalent capacitance, $C_{eq} = 2.66 + 20$
$(C_{eq}) = 22.66$ μF

8. Determine the separation between the plates (in mm)of a parallel plate capacitor placed in air, when the area of the plates is 0.002 sq. meter, the voltage of the battery connected to this parallel plate capacitor is 4 V and the charge stored on the plates is 16 pC.

(a) 4.4   (b) 2.6
(c) 5.8   (d) 6.4

Ans : (a) Area of plate $= 0.002$ meter^2
Voltage (V) $= 4$ Volt
Charge (q) $= 16 \times 10^{-12}$ Coulomb
$\varepsilon_0 = 8.85 \times 10^{-12}$ Farad/meter
Capacitance (C) $= \dfrac{q}{V} = \dfrac{16 \times 10^{-12}}{4} = 4 \times 10^{-12}$
$(C) = \dfrac{\varepsilon_0 \varepsilon_r A}{d}$
$4 \times 10^{-12} = \dfrac{8.85 \times 10^{-12} \times 1 \times 0.002}{d}$
$\boxed{d = 4.4\,mm}$

9. Determine the power (in W) delivered by the current source to the given electrical circuit
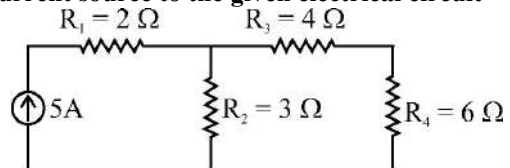
(a) 92.5   (b) 107.5
(c) 104.2   (d) 93.7

Ans : (b) In the given circuit, 4 Ω and 6 Ω are in series, so
$R_1 = 4 + 6 = 10$ Ω
Similarly, 3Ω and 10Ω are in parallel,
So, $R_t = 10 \parallel 3 = \dfrac{10 \times 3}{10+3} = \dfrac{30}{13}\Omega$
then, R_2 and 2Ω are series, so equivalent resistance across current source is,
$R_{eq} = \dfrac{30}{13} + 2 = \dfrac{56}{13}\Omega$
So, Power delivered by the current source,
$P = I^2 R$
$P = (5)^2 \times \dfrac{56}{13}$
$P = 107.69$ watt

10. Determine the power (in W) of lamp A and lamp B respectively for the given circuit diagram.
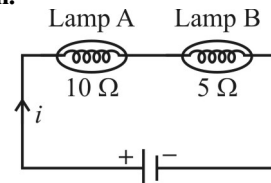
(a) 75.56, 33.64   (b) 76.65, 38.86
(c) 70.76, 35.37   (d) 68.62, 38.86

Ans : (c) Given that
Supply voltage $= 40$ volt
Total resistance, $R_{eq} = 10 + 5$ ($\because$ 10Ω and 5Ω are in series)
$\because$ Current $I = \dfrac{V}{R}$

$I = \dfrac{40}{15} = 2.66\,A$

Power dissipated across $10\,\Omega$ resistance $P_A = I^2 R$

$\qquad = (2.66)^2 \times 10 = 70.756\,W$

$\qquad = 70.76\,W$

Power dissipated across $5\,\Omega$ resistance $P_B = I^2 R$

$\qquad = (2.66)^2 \times 5 = 35.378\,W$

$\qquad = 35.38\,W$

So, power across lamp A and lamp B are 70.76 W and 35.38 W

11. **Which one of the following statement is TRUE?**
    (a) Superposition theorem is not applicable for voltage calculation.
    (b) Superposition theorem is not applicable for power calculation.
    (c) Superposition theorem is not applicable for bilateral elements.
    (d) Superposition theorem is not applicable for passive elements.

Ans : (b) Superposition theorem is not applicable for power calculation. Superposition theorem is applicable only for linear network. Superposition theorem is not used in the circuit which has only dependent source.

The current through, or voltage across an element in a linear bilateral network equal to the algebraic sum of the current or voltage produced independently by each source.

12. **Which one of the following is an active element in a circuit?**
    (a) Capacitor   (b) Resistance
    (c) Inductor   (d) Current source

Ans : (d) Current source is an active element because active elements are those, which has one or more e.m.f. source and is capable of generating electrical energy.
Active components deliver power or energy to circuit.
Active components are energy donor, they require an external source for the operation. Active components can control the flow of current.
Passive element – Passive element is an electronic, component which can only receive energy.
Ex. Resistance (R), Inductor (L), Capacitor etc.

13. **The closed path made by the combination of several branches of the network is called as..............**
    (a) terminal   (b) circuit
    (c) loop   (d) junction

Ans : (c)
• The closed path made by the combination of several branches of the network is called as "loop".
• A loop is a closed path in a circuit where two nodes are not traversed twice except the initial point, which is also the final one.
• In a loop other paths can be included inside.
• While a mesh is a closed path in a circuit with no other paths inside it. In other words, a mesh with no other loops inside it.

14. **Which one of the following is the statement of Ohm's law?**
    (a) Voltage is always equal to current.
    (b) Voltage is inversely proportional to current.
    (c) Current is directly proportional to the voltage.
    (d) Current does not depend on the voltage.

Ans : (c) According to ohm's law, voltage is directly proportional to current,

$\qquad V \propto I$
$\qquad V = IR$

$$\boxed{R = \dfrac{V}{I}}$$

15. **What will be the value of current I_5 (in A) for the given network?**
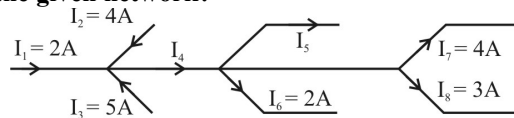
    (a) 2   (b) 4
    (c) 3   (d) 1

Ans : (a) By applying kCL is the given circuit, where sum of incoming current is equal to sum of outgoing current at the same node.
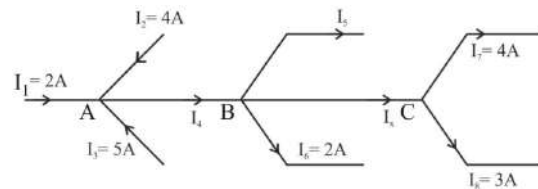
At node A,
$\qquad I_1 + I_2 + I_3 = I_4$
$\qquad I_4 = 2 + 4 + 5$
$\qquad = 11\,A$

At node C,
$\qquad I_x = I_7 + I_8$
$\qquad I_x = 4 + 3$
$\qquad I_x = 7\,A$

At node B,
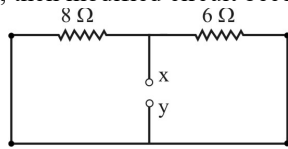$\qquad I_4 = I_5 + I_6 + I_x$
$\qquad 11 = I_5 + 2 + 7$

$\qquad \boxed{I_5 = 11 - 9 = 2\,A}$

16. **Determine the Thevenin's equivalent resistance (in ohms) across terminals x and y for the given electrical circuit.**
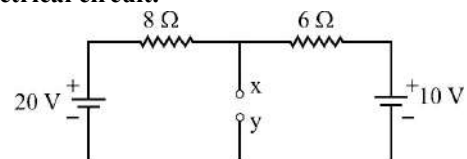
    (a) 1.21   (b) 2.32
    (c) 3.43   (d) 4.54

Ans : (c) According to the Thevenin's theorem, Voltage source is short circuited and current source is open circuited, then modified circuit becomes.
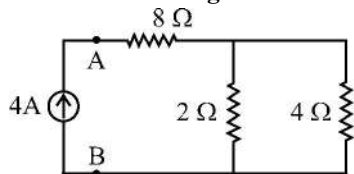

In the given circuit, 6Ω and 8Ω resistance are in parallel.
So, thevenin's in resistance,

$$R_{th} = \frac{8 \times 6}{8 + 6}$$

$$\boxed{R_{th} = 3.43\Omega}$$

17. What will be the voltage (in V) between points 'A' and 'B' in the given electrical circuit?

(a) 38.25   (b) 37.32
(c) 36.62   (d) 32.24

Ans : (b) In the given circuit 4Ω and 2Ω resistance are in parallel, so equivalent resistance,

$$R = \frac{2 \times 4}{2 + 4} = \frac{8}{6} = \frac{4}{3}\Omega$$

Now, $\frac{4}{3}\Omega$ and 8Ω resistance are in series so resistance

$$R_{eq} = 8 + \frac{4}{3} = \frac{28}{3}\Omega$$

Voltage across current source, $V = IR$

$$= 4 \times \frac{28}{3} = 37.32 \text{ volt}$$

18. What will be the voltage (in V) at node A of the given circuit diagram?
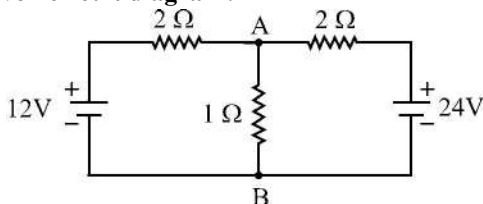
(a) 24   (b) 12
(c) 10   (d) 9

Ans : (d) On applying KCL or Nodal in the given circuit,

$$\frac{V_A - 12}{2} + \frac{V_A}{1} + \frac{V_A - 24}{2} = 0$$

$$\frac{V_A}{2} - 6 + V_A + \frac{V_A}{2} - 12 = 0$$

$$2V_A = 18$$

$$V_A = 9 \text{ volt}$$

So, 9 volt applicable node A.

19. What will be the current (in A) through 4 ohms resistor, if a source of 4 V with internal resistance of 2 ohms is connected at x-y terminals with positive terminal at x?
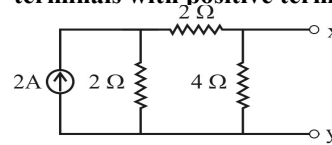
(a) 0.75   (b) 0.24
(c) 1.62   (d) 1.44

Ans : (a) Current-source is conversed into voltage source.
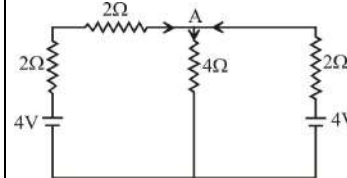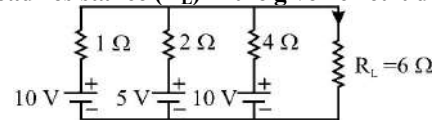

On applying Nodal analysis at node A,

$$\frac{4 - V_A}{2 + 2} + \frac{4 - V_A}{2} = \frac{V_A}{4}$$

$$\frac{4V_A}{4} + \frac{4 - V_A}{2} = \frac{V_A}{4}$$

$$\boxed{V_A = 3V}$$

So, current flowing through 4Ω resistance $= \frac{3}{4} = 0.75\,A$

20. Find the value of current (in A) through the load resistance (R_L) in the given circuit diagram?

(a) 2.2   (b) 1.3
(c) 2.6   (d) 2.25

Ans : (b) On applying, Milliman's theorem in the given circuit,

$$E_m = \frac{\dfrac{E_1}{R_1} + \dfrac{E_2}{R_2} + \dfrac{E_3}{R_3} + \cdots\cdots\cdots \dfrac{E_n}{R_n}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \cdots\cdots\cdots \dfrac{1}{R_n}}$$

$$E_m = \frac{\dfrac{10}{1} + \dfrac{5}{2} + \dfrac{10}{4}}{\dfrac{1}{1} + \dfrac{1}{2} + \dfrac{1}{4}}$$

$$E_m = \frac{10 + \dfrac{5}{2} + \dfrac{5}{2}}{1 + \dfrac{1}{2} + \dfrac{1}{4}} = \frac{15}{1.75}$$

$$R_{th} = \frac{1}{\dfrac{1}{1} + \dfrac{1}{2} + \dfrac{1}{4}} = \frac{1}{1.75}$$

So, current in 6Ω resistance

$$I = \frac{E_m}{R_L + R_{th}} = \frac{15}{1.75} \times \frac{1}{6 + \dfrac{1}{1.75}} = 1.3 \, A$$

21. The S.I. unit magnetic permeance is ....
  (a) Henry   (b) Weber
  (c) Tesla   (d) Coulomb

Ans : (a) • S.I. unit of magnetic permeance is Henry. Magnetic permeance is reciprocal of Reluctance. Permeance is analogous to the conductance in an electrical circuit. It is a quality of material by which flux can be set up in a material.

It is the measure of the case with which flux can be set up in a materials

$$P = \frac{1}{S}$$

$$P = \frac{A\mu_0\mu_r}{(\ell)} \quad \text{unit} - \frac{wb}{AT}$$

Where A= cross-sectional area
    ℓ = magnetic path length
    μ_0 = permeability of vacuum
    μ_r = Relative permeability of air
• Pearmeance is analogous to the conductance in an electrical circuit

22. Which one of the following is the CORRECT expression of magnetic reluctance?
  (a) $\dfrac{l}{H}$ (b) $\dfrac{B}{H}$
  (c) $\dfrac{\phi}{F_m}$ (d) $\dfrac{F_m}{\phi}$

Ans : (d) The reluctance of a material to the setting up of magnetic flux lines in a material is determined by following equation.

$$\boxed{S = \frac{\ell}{\mu A}}$$

Expression of magnetic reluctance is $S = \dfrac{F_m}{\phi}$.

Where F_m = N.I. (magneto-motive force)

$$\phi = \frac{NI}{S} \qquad \therefore \qquad S = \frac{mmf}{\phi} \text{ or } \frac{F_m}{\phi}$$

$$\boxed{S = \frac{F_m}{\phi}}$$

Where, $S \rightarrow$ Magnetic reluctance (Henry^{-1}),
    ϕ = Magnetic flux
Dimension = $M^{-1} L^{-2} T^2 A^2$

23. Determine the produced mmf (in Amp-turns) in a magnetic circuit if it has 60 turns and carrying a current of 0.5 A.
  (a) 10   (b) 20
  (c) 30   (d) 40

Ans : (c) Give that, N = 60 turns Current = 0.5 Amp.
∴ Magneto-motive force (mmf) = N.I.
        mmf = 60 × 0.5
        mmf = 30 A.T

24. Magnetic flux through any closed surface is......
  (a) one   (b) infinite
  (c) zero   (d) negative

Ans : (c) : According to Gauss's law :-

$$\boxed{\phi_B = \iint_s \mathbf{B.ds}}$$

Where, s = Closed surface
    B = Magnetic flux density,
    ϕ_B = Magnetic flux.
SI unit of Magnetic flux is weber (volt-seconds)
In CGS = Maxwell

25. Determine the magnitude of induced EMF (in V) in a coil, if the current changes from +2 A to −2A in 0.5 seconds and the coefficient of mutual induction is 0.5.
  (a) 2   (b) 4
  (c) 3   (d) 6

Ans : (b) : Given that, time , t = 0.5 sec.
Coefficient of mutual induction (M) = 0.5
Change in current, di = 4 A

$$\frac{di}{dt} = \frac{2-(-2)}{0.5} = \frac{4}{0.5} = 8 \text{ Amp/Second}$$

Induced emf (e) = $M \dfrac{di}{dt}$
        (e) = 0.5 × 8
        (e) = 4 volt.

26. Determine the self-inductance (in mH) of a 4 m long air-cored solenoid, if the solenoid has a cross sectional area of 0.02 square meter and has 60 turns.
  (a) 0.064   (b) 0.036
  (c) 0.045   (d) 0.023

Ans : (d) : Given that,
    length of core (ℓ) = 4 m
    Area of core (A) = 0.02 m^2
    No. of turn N = 60

Self inductance, (L) = $\dfrac{\mu_0\mu_r N^2 A}{\ell}$ $(\because \mu_r = 1 \text{ for Air})$

$$= \frac{4\pi \times 10^{-7} \times 60 \times 60 \times 0.02}{4}$$

L = 0.023 mH

27. Determine the value of magnetic field (in mT) at the center of a 20 cm long solenoid, if the solenoid has 200 turns and carrying a current of 4 A.
  (a) 5   (b) 8
  (c) 9   (d) 11

Ans : (a) Given that,
N = 200
Current, I = 4 A
length (l) = 20 cm = 0.2 m

Field strength, (H) = $\dfrac{NI}{\ell} = \dfrac{200 \times 4}{0.2} = 4000$ AT/m

flux density (B) = $\mu_0\mu_r H$
    B = $4\pi \times 10^{-7} \times 4000$ $(\because \mu_r = 1 \text{ Air})$
    B = 16000 × 3.14 × 10^{-7} = 50240×10^{-7}T
    $\boxed{B = 5mT}$

28. What will be the magnitude of magnetic field (in T) acting parallel to the rotation of the disc of diameter 20 cm when the magnitude of EMF induced between the axis of rotation and the rim of the disc is 10 V and the angular speed of rotation of disc is 20 revolutions per second.

(a) 12.8   (b) 14.3
(c) 15.9   (d) 16.8

Ans : (c) Given that,

Radius $(r) = \dfrac{20}{2} = 10$ cm

rpm rate = 20 revolution/sec.

$e = 10$ V

induced e.m.f. $(e) = \phi \times$ rate

$\phi = \dfrac{10}{20} = 0.5$ Wb

Magnetic field $(B) = \dfrac{\phi}{A}$

$B = \dfrac{0.5}{\pi r^2} = \dfrac{0.5}{3.14 \times \left(10 \times 10^{-2}\right)^2}$

$\boxed{B = 15.9 \text{ T}}$

29. Determine the magnetic susceptibility of a material, if the field strength of the materials is 0.8×10^5 A.m^{-1} and the magnitude of magnetization is 0.97×10^5 A.m^{-1}.

(a) 1.01   (b) 1.21
(c) 1.41   (d) 1.61

Ans : (b) Given that,
Field strength, (H) = 0.8×10^5 A-m^{-1}
Magnitude of magnetization (M) = 0.97×10^5 A-m^{-1}

So, magnetic susceptibility $(\chi_m) = \dfrac{M}{H} = \dfrac{0.97 \times 10^5}{0.8 \times 10^5}$

$\boxed{\chi_m = 1.21}$

30. What will be the magnitude of the induced EMF (in V) in a coil area of 100 square centimeters with 200 turns, If the coil is removed from a magnetic field of 10 T acting at right angles to the coil in 1 second.

(a) 10   (b) 30
(c) 60   (d) 20

Ans : (d) A = 100 cm^2
      = 100×10^{-4} m^2 = 10^{-2} m^2
N = 200 Turn
B = 10 Tesla
t = 1 sec

formula, $V = -\dfrac{N d\phi}{dt}$

$\because \phi = B.A$ $\left(\because A = 10^{-2}\right)$

$V = -200 \times 10^{-2} \times \dfrac{dB}{dt}$ $\{\phi = BA\}$

$= -200 \times 10^{-2} \times \left(\dfrac{0-10}{1}\right)$

$\boxed{V = 20 \text{ Volt}}$

31. What will be the instantaneous value of the alternating voltage (in V) which is represented by v(t) = 120 sin(11t – 20)V, when the value of time is 10?

(a) 0   (b) 60
(c) 84.85   (d) 120

Ans : (d) Given that,
      v(t) = 120 sin (11t – 20)V
      t = 10
      v(t) = 120 sin (11 × 10 – 20)V
      v(t) = 120 sin 90° = 120 volt

32. What is the peak value of the alternating current (in A) having RMS value of 18 A?

(a) 25.46   (b) 28.3
(c) 33.34   (d) 35.99

Ans : (a) V_{rms} = 18 Amp
      $V_{max} = V_{rms} \times \sqrt{2}$
      $V_{max} = 18 \times \sqrt{2}$
      $V_{max} = 18 \times 1.414 = 25.452$
      $V_{max} = 25.46$ volt

33. What will be the value of capacitive reactance (in ohms) of a circuit, if it is supplied with 25 Hz supply, if the capacitive reactance of the circuit is 30 Ohms, when it is supplied with a 100 Hz supply?

(a) 50   (b) 60
(c) 75   (d) 120

Ans : (d) Given that,
      f_1 = 100 Hz, f_2 = 25 Hz
Capacitive reactance (X_c) = 30 Ω

$X_c = \dfrac{1}{2\pi f C}$

$C = \dfrac{1}{2\pi f X_c} = \dfrac{1}{6.28 \times 100 \times X_c}$

$C = \dfrac{1}{628 \times 30} = \dfrac{1}{18840} = 0.00005307 = 53\mu F$

then, f_2 = 25

$X_c = \dfrac{1}{2\pi f c}$

$X_c = \dfrac{1}{2 \times 3.14 \times 25 \times 53 \times 10^{-6}}$

$= \dfrac{10^6}{157 \times 53} = \dfrac{10^6}{8321}$

$\boxed{X_c = 120 \Omega}$

34. A series RLC circuit has a capacitance, inductance and resistance of 0.018 mF, 2 mH and 10 Ohms respectively. What is the resonant frequency (in kHz) of the circuit?

(a) 13.26   (b) 26.52
(c) 53.04   (d) 79.56

Ans : (*) Given that,
      R = 10Ω, L = 2×10^{-3} Henry
      C = 0.018×10^{-3} Farad

resonant frequency, $(f_r) = \dfrac{1}{2\pi\sqrt{LC}}$

$$= \frac{1}{6.28\sqrt{2\times10^{-3}\times0.018\times10^{-3}}}$$

$$= \frac{1}{6.28\sqrt{0.036\times10^{-6}}} = 840.34 \text{ Hz}$$

$$= 0.84\,\text{KHz}$$

Note- Commission declares No correct answer.

35. **What is the value of current (in A) at half power of a series RLC circuit at resonance, when the maximum value of current is 20 A?**
   (a) 5   (b) 10
   (c) 12.74   (d) 14.14

Ans : (d) $P = I^2 R$,

$\because P \propto I^2$,

$P_1 = P$, $P_2 = \dfrac{P}{2}$

$I_1 = 20$, then, $I_2 = ?$

$$\left(\frac{P_1}{P_2}\right) = \left(\frac{I_1}{I_2}\right)^2$$

$$\Rightarrow \frac{P}{P/2} = \left(\frac{20}{I_2}\right)^2$$

$$I_2 = \frac{20}{\sqrt{2}}$$

$$I_2 = 14.14\,\text{Amp}.$$

36. **What is the value of quality factor of a series RLC circuit having capacitance of 0.01 mF, inductance of 1 mH and resistance of 75 Ohms**
   (a) 0.133   (b) 0.267
   (c) 1.333   (d) 2.667

Ans : (a) Given that,
$C = 0.01 \times 10^{-3}$ farad, $L = 1 \times 10^{-3}$, Henry
$R = 75\Omega$

So, Quality factor (Q.F.) = $\dfrac{1}{R}\sqrt{\dfrac{L}{C}}$

$$\text{Q.F.} = \frac{1}{75}\sqrt{\frac{1\times10^{-3}}{0.01\times10^{-3}}} = \frac{1}{75}\sqrt{100}$$

$$\text{Q.F.} = 0.133$$

So, Quality factor   = 0.133

37. **Which of the following is CORRECT about series RLC circuit?**
   (a) Its bandwidth decreases with decrease in inductance.
   (b) Its bandwidth decreases with decrease in resistance.
   (c) Its bandwidth decrease with increase in resistance.
   (d) Its bandwidth is independent of both inductance and resistance.

Ans : (b) In series RLC circuit, its bandwidth decreases with decreases in resistance because in series RLC circuit value of bandwidth depends on ratio Resistance and inductance.

$$\boxed{\text{B.W} = \frac{R}{L}}$$

$$\boxed{\text{B.W} \propto R}$$

B.W.=Higher power frequency– Lower power frequency

38. **The reading of wattmeter and ammeter is 1 kW and 10 A respectively in the three phase circuit given below. What is the value of power factor of the circuit, if the circuit is balanced?**
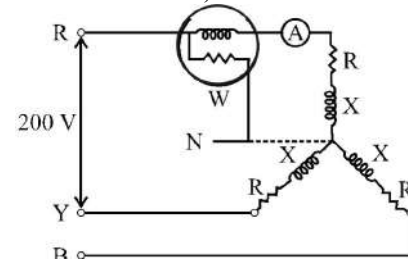
   (a) 0.5   (b) 0.65
   (c) 0.74   (d) 0.86

Ans : (d) Reading of wattmeter = 1 kW = 1000 watt

$$V_{ph} = \frac{V_L}{\sqrt{3}} = \frac{200}{\sqrt{3}}, \qquad I_L = I_{ph}$$

$$P = V_L \times I_L \cos\phi$$

$$1000 = \frac{200}{\sqrt{3}}\times10\times\cos\phi$$

$$\cos\phi = \frac{1.732\times1000}{200\times10} = 0.866$$

So, $\boxed{\cos\phi = 0.866}$

39. **What is the number of watt-meters required to measure the power of a poly phase system containing 'n' conductors?**
   (a) 0   (b) n – 1
   (c) n   (d) n + 1

Ans : (b) According to Blondel's theorem-
If system is n phase, (n+1) wire, then n watt-meter is needed.
If system is n phase, n wire, then (n-1) watt-meter is needed.
But if system is balanced then one wattmeter is sufficient.

40. **What is the apparent power of a 3-phase star connected system having phase voltage of 254.05 V and line current of 10 A and the phase difference between the voltage and current is 45 degrees?**
   (a) 5.4kW   (b) 5.4 kVA
   (c) 7.62kW   (d) 7.62 kVA

Ans : (d) Given that,
$V_{ph} = 254.05$ V $\left(\because I_L = I_{ph}\right)$
$I_L = 10$ Amp
$\phi = 45^\circ$
Apparent powers $= 3 \times V_{ph} \times I_{ph} = 3 \times 254.05 \times 10$

$$\boxed{S = 7.62\,\text{kVA}}$$

Note:- Commission declares 5.4 kVA as a right.

41. Which of the following is the dimension of power?

(a) $\dfrac{ML^2}{T^3}$ (b) $\dfrac{T^2}{ML^2}$

(c) $\dfrac{ML^2}{QT^2}$ (d) $\dfrac{ML^2}{QT}$

Ans : (a) Dimension of power is $\dfrac{ML^2}{T^3}$

$$P = \frac{W}{t} = \frac{ML^2T^{-2}}{T}$$

$$= ML^2\,T^{-3} = \boxed{\left[\frac{ML^2}{T^3}\right]}$$

42. A factory runs in 4 shifts of 6 hours each, in which it consumes 36 kW, 86 kW, 50 kW and 20 kW in each shift respectively. Calculate the energy (in kWh) consumed by the factory per day.

(a) 216 (b) 557
(c) 1152 (d) 1920

Ans : (c) Total Power = 36 + 86 + 50 + 20 = 192 kW
Consumed energy = 192 × 6
$\boxed{= 1152 \text{ kWh}}$

43. In 'Two-wattmeter method' of power calculation of a 3-phase balanced star connected system, what is the power factor of the system, if one of the wattmeter's shows negative reading and the other shows a positive reading?

(a) Greater than or equal 0 but less than 0.5
(b) 0.5
(c) Greater than 0.5 but less than equal to 1
(d) Greater than 1

Ans : (a) When the value of angle is less than 60º greater than 90º then the value of power factor is greater than zero and less then 0.5, So the reading of one wattmeter is positive and others is negative.

44. Which of the following is NOT a feature of MI type instruments?

(a) Can be used in both AC and DC circuit.
(b) Moving element is a small soft iron piece.
(c) Uniformly divided scale or non-uniform scale.
(d) Low cost of instrument in comparison to moving coil instruments.

Ans : (c) Scale of moving Iron type instruments is non-uniform because in MI type instruments $\boxed{\theta \propto I^2}$ When θ = deflection angle.
It works for AC and DC both. Its accuracy is less then moving coil instrument.

45. What is the phase shift (in degrees) between the signals, which is indicated by the Lissajous pattern given below?
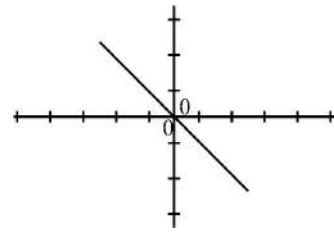
(a) 0 (b) 60
(c) 90 (d) 180

Ans : (d) Phase shift between signal θ = 45 + 90 + 45 = 180°
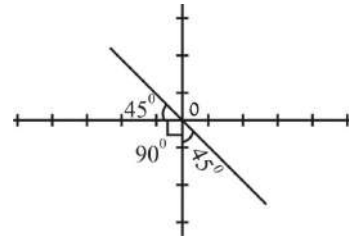
46. Which of the following is used to measure the power in very high voltage circuits with a low rating wattmeters?

(a) Cannot be measured
(b) Instrument transformer is used
(c) Full wave rectifier is used
(d) Few number of wattmeter transformer is used

Ans : (b) Instrument transformer is used to measure the power in very high voltage circuit with a low rating wattmeters. Instrument transformers are of two type- Current transformer and voltage transformer. Current transformer and used to measure high current. Similarly voltage transformer are used for high voltage.

47. What is the smallest change in the input signal that can be detected by an instrument called?

(a) Accuracy (b) Precision
(c) Resolution (d) Sensitivity

Ans : (c) The smallest change in the input signal which is detected by an instrument called Resolution. It is used highly in electronic measurement instrument as compared to electric measuring instrument.

48. Which of the following is TRUE in case of current transformers?

(a) It helps in measuring high current using high range ammeter.
(b) It helps in measuring high current using low range ammeter.
(c) It helps in measuring high voltage using high range voltmeter.
(d) It helps in measuring low voltage using high range ammeter.

Ans : (b) Current transformer helps in measuring high current using low range ammeter. Secondary winding of current transformer is always short circuited. Current transformer is connected in series with the electrical circuit.

49. What is the angle between (in degrees) the planes of two moving coils of a dynamometer type 3-phase power factor meter?

(a) 0 (b) 60
(c) 90 (d) 120

Ans : (d) Angle between planes of two moving coils of a dynamometer type 3-phase power factor meter is 120°. Where as in single -phase type dynamometer, the angle between planes of two moving coils is 90°. In three phase power factor meter have two immovable current coils and 2 or 3 movable voltage coils.

50. **What is the reading (in kW) of both the wattmeter, when measuring the power of a three-phase three wire system having an input of 5 kW and power factor of 0.866?**
    (a) 5, 0   (b)   3.33, 1.67
    (c) 2.5, 2.5   (d)   1, 4

Ans : (b) Given that,

$P = 5\,kW$, $\cos\phi = 0.866$, $\phi = 30^0$

$P_1 + P_2 = 5\,kW$ ....(i)

We know that, $\tan\theta = \sqrt{3}\left(\dfrac{P_1 - P_2}{P_1 + P_2}\right)$

$\tan 30^0 = \sqrt{3}\left(\dfrac{P_1 - P_2}{5}\right) \Rightarrow \dfrac{1}{\sqrt{3}} = \sqrt{3}\left(\dfrac{P_1 - P_2}{5}\right)$

$5 = 3\,(P_1 - P_2)$

$P_1 - P_2 = \dfrac{5}{3} = 1.66$

$P_1 - P_2 = 1.66\,kW$ ....(ii)

from equation (i) and (ii),

$\boxed{P_1 = 3.33\,kW}$

$\boxed{P_2 = 1.67\,kW}$

51. **Commutator in DC generator is used for**
    (a) collection of current
    (b) reduce losses
    (c) increase efficiency
    (d) convert AC armature current in DC

Ans : (d) Commutator in DC generator is used to convert AC (armature current) into DC. Commutator is also known as mechanical rectifier.

52. **Tappings of a transformer are provided**
    (a) at the phase end of l_v side
    (b) at the phase end of h_v side
    (c) at the neutral side end of h_v side
    (d) at the middle of h_v side/

Ans : (d) Taping of a transformer are provided at the middle of high voltage side. Because if tapping is provided on low voltage side, current interruption becomes tough due to increment in current.

53. **DC machine winding are**
    (a) full pitched   (b)   short pitched
    (c) either of these   (d)   none of these

Ans : (a) DC machine winding are full pitched type. because it offers maximum induced emf within the coil. No requirement of short pitching of coil like alternator.

54. **The armature winding is connected to the external power source through a**
    (a) commutator system
    (b) brush system
    (c) commutator brush system
    (d) none of these

Ans : (c) The armature winding is connected to the external power source through a commutator brush system. Unidirectional torque is achieved with the help of commutator and brush. GNA is always exists on quadrature axis in DC machine and MNA is always perpendicular to the resultant flux. Brush shift of the DC machine is always depends on armature current.

55. **The emf induced in the dc generator armature winding is**
    (a) AC   (b)   DC
    (c) AC & DC   (d)   None of these

Ans : (a) The e.m.f. induced in the dc generator armature winding is AC, which is converted into DC with the help of commutator.

56. **In an Auto transformer a part of energy transfer is through**
    (a) convection process   (b) conduction process
    (c) induction process   (d) both (b) and (c)

Ans : (d) In auto transformer there is a common electrical path between primary and secondary, so power is transferred through both conduction and induction process. Efficiency of auto transformer is high as compared to two winding transformer. Auto transformer gives variable output voltage where conventional transformer gives constant voltage. Auto transfer in used as a starter in an induction motor, as a voltage regulator, in railways etc.
Note :- Commission declares No correct answer.

57. **Voltage regulation of transformer is given by**
    (a) $(E^2 - V^2)/V^2$ (b) $(E^2 - V^2)/E^2$
    (c) $V^2 - E^2/E^2$ (d) $(V^2 - E^2)/V^2$

Ans : (*) Voltage regulation of transformer =

$$\dfrac{\text{No load Voltage} - \text{Full load Voltage}}{\text{Full load Voltage}}$$

$$= \dfrac{V_N - V_F}{V_F}$$

Where V_N = No load voltage
        V_F = Full load voltage
Note :- Commission declare No Correct Answer.

58. **Which is the only transformer whose primary and secondary are connected to each other electrically?**
    (a) Shielded Winding transformer
    (b) Insulating transformer
    (c) Auto transformer
    (d) Isolating transformer

Ans : (c) Auto transformer is a type of transformer primary and secondary windings are electrical connected with each other. So it has only one winding. In this power is transferred by induction and conduction both.

59. **In a 3-phase induction motor a balanced three phase supply is with electrical angle separation**
    (a) 30°   (b)   60°
    (c) 90°   (d)   120°

Ans : (d) In a three phase induction motor a balanced three phase supply is with electrical angle separation with 120°. In this phase R–Y–B are separated or placed with 120° phase angle.

60. The slip of induction motor 0.04 and frequency of motor 60 Hz. Hence, the rotor current frequency
(a) 24 kHz   (b) 24 Hz
(c) 2.4 Hz   (d) 60 Hz

Ans : (c) Given that,
Slip $= 0.04$
Frequency (f) $= 60$ Hz
Rotor frequency $(f_r) = $ s.f.
$f_r = 60 \times 0.04$
$f_r = 2.4$ Hz

61. Which single phase motor would you select for a tape recorder?
(a) Reluctance motor   (b) Hysteresis motor
(c) Synchronous motor   (d) Universal motor

Ans : (b) Hysteresis motor is selected for a tape recorder, because it has no winding in rotor. It is single phase synchronous motor, which runs only on synchronous speed.

62. The direction of rotation of an hysteresis motor is determined by
(a) interchanging the supply leads
(b) position of shaded pole with respect to main pole
(c) retentivity of the rotor material
(d) none of these

Ans : (b) The direction of rotation of an hysteresis motor is determined by position of shaded pole with respect to main pole.

63. In a capacitor start and run motors the function of the running capacitor in series with the auxiliary winding is to.......
(a) improve power factor
(b) increase overload capacity
(c) reduce fluctuations in torque
(d) to improve torque

Ans : (a) Work of capacitor start and run motors are to modify power factor. This motor works as a two phase induction motor in running and starting both condition. This motor has good starting and running power factor. value of used starting capacitor in this motor is 10 to 15 times of running capacitor.

64. The purpose of stator winding in the compensated repulsion motor is to
(a) provide mechanical balance
(b) improve power factor and provide better speed regulation
(c) prevent hunting in the motor
(d) eliminate armature reaction

Ans : (b) The purpose of stator winding in the compensated repulsion motor is to improve power factor and provide better speed regulation. This motor is a commutator type motor. The value of running torque is maximum in this motor, when the value of α is 45º. Repulsion motor behaves as a D.C. series motor.

65. A hysteresis motor works on the principle of
(a) hysteresis loss
(b) magnetisation of rotor
(c) eddy current loss
(d) electromagnetic induction

Ans : (a) A hysteresis motor works on the principle of hysteresis loss. It is a synchronous motor with a uniform air gap and without DC excitation. It operates both in single and three phase supply. The torque in a hysteresis motor is produced due to hysteresis and eddy current induced in the rotor by the action of the rotating flux of the stator winding.
Note : According to the commission correct answer (b).

66. Torque developed by a single phase induction motor at starting is
(a) pulsating   (b) uniform
(c) non-uniform   (d) zero

Ans : (a) Torque developed by a single phase induction motor at starting is pulsating. Single phase induction motor operates on single phase A.C. and torque is produced due to induction of electricity caused by the alternating magnetic fields. When 1-ϕ supply is connected to stator winding, a pulsating magnetic field is produced. The rotor does not rotate due to inertia. So it is not a self starting motor.

67. What are the advantage of DC transmission system over AC transmission system?
(a) DC system is economical
(b) There is no skin effect in DC system
(c) Corona limits are highest for DC circuits as compared to AC circuits
(d) All options are correct

Ans : (b) Advantage of DC transmission system over AC transmission system is that there is no skin effect in DC system. It has also minimum corona limits. But its installation cost is high.

68. The high voltage line which feeds the substations, distribution transformers represent
(a) primary transmission
(b) secondary transmission
(c) primary distribution
(d) secondary distribution

Ans : (c) The high voltage line which feeds the substations, distribution transformers represent primary transmission. Distribution line on the high voltage side of distribution transformer are called primary distribution.

69. Which of the following is not a standard transmission voltage?
(a) 132 kV   (b) 222 kV
(c) 400 kV   (d) 750 kV

Ans : (b, d) 222 KV and 750 KV are not a standard transmission voltage. Standard transmission voltages 756KV, 400KV, 220 KV, 132 KV, 110 KV, 66 KV, and 33 KV. So from the given options (b) and (d) both are correct
Note- Commission declares No correct answer.

70. Dielectric strength of rubber is around
(a) 3 kV/mm   (b) 10 kV/mm
(c) 30 kV/mm   (d) 300 kV/mm

Ans : (c) Dielectric strength of rubber is around 30kV/mm. rubber is a insulating material, which is used in cable for insulation. Rubber, PVC, XLPE etc. are used for voltage below than 1kV, whereas paper is used for voltage above 1kV.

71. The number of conductors in a double circuit transmission line is
(a) one earth conductor along with four conductors
(b) one earth conductor along with six conductors
(c) one earth conductor along with seven conductors
(d) one earth conductor along with eight conductors

Ans : (b) The number of conductors in a double circuit transmission line is on earth conductor along with six conductors.

72. The earth conductor carried in high voltage transmission line is
(a) above the line conductors
(b) below the line conductors
(c) between the line conductors
(d) none of these

Ans : (a) The earth conductor carried in high voltage transmission line is above the line conductors. Earth wire protects line conductor from direct lightning. Every fourth pole or tower is grounded to send light stroke directly in ground.

73. The type of wiring that is highly suitable for a temporary shed is
(a) cleat wiring
(b) wooden capping and casing wiring
(c) lead sheathed wiring
(d) conduit wiring

Ans : (a) Cleat wiring is highly suitable for a temporary shed. Cleat wiring has low cost. The weather conditions are directly affected on cables such as rain, oil, vapour, stream, humidity, smoke etc. It is used only on low temperature places. This wiring system is not safe and durable.

74. To prevent excessive brightness, which type of lighting scheme is used?
(a) direct   (b) indirect
(c) general   (d) local

Ans : (b) To prevent excessive brightness, indirect lighting scheme is used. In this lightning system, 90% of the total light is dispersed on ceiling and surface glows from inverted reflector.
Indirect lighting scheme is used in cinema, Theater, workshop etc.

75. Ohm's law is not applicable to–
(a) Constant and Variable Temperatures
(b) Constant Temperature
(c) Variable temperature
(d) Any of the options

Ans : (c) Ohm's law is not applicable for variable temperature. According to ohm's law, ratio of voltage and current is a constant, which is called as a Resistance.
$\dfrac{V}{I}$ Characteristics graph is a straight line.
In Ohm's law, atmospheric incident lie temperature, wind, humidity etc are assumed a constant.
Ohm's law is not applicable on non-linear devices, electrolyte, semiconductor etc.

76. Most of the fuses operate due to
(a) heating effect of current
(b) magnetic effect of current
(c) electrostatic effect of current
(d) induction effect of current

Ans : (a) Most of the fuses operate due to the heating effect of current.
Generated heat in fuse wire $(H_P) = I^2 Rt$
Where, t = Time
R = Resistance (Ohm)
I = Current (Ampere)

77. Pin insulators are normally used up to voltage of about
(a) 33 KV   (b) 66 KV
(c) 100 KV   (d) 11 KV

Ans : (a) Pin insulators are normally used up to voltage of about 33 kV, It is used in power distribution. It is placed on the cross arm of the supporting tower. The Pin insulator used non-consisting material like porcelain, ceramic, silicon, rubber, etc.
The Pin of the insulator damaged the insulator thread.

78. The core of the transformer is made of
(a) copper   (b) aluminium
(c) air   (d) laminated sheath

Ans : (d) The core of the transformer is made of laminated sheath. CRGO type core is used for power transformer. HRGO type core is used for distribution transformer. Flux density of CRGO is 1.4 Wb/m² to 1.8 Wb/m² and flux density of HRGO is 1.2 Wb/m² to 1.4 Wb/m².

79. Forced draft fan handling which type of air
(a) cold air   (b) hot air
(c) flue gas only   (d) fresh air only

Ans : (a) Forced draft fan handles cold air. Forced draft inserts air into fan boiler.

80. Who invented the alternating current?
(a) Tesla   (b) Faraday
(c) Maxwell   (d) Edison

Ans : (a) Nikola Tesla invented the alternating current. Invention of AC motor was also done by Tesla in 1888 year. All AC machine like induction motor invented by him so induction motor is also known as Tesla motor.

81. The function of inert gas in filament lamp is
(a) increase the illumination
(b) decrease the power consumption
(c) minimize the effect of evaporation during service
(d) decrease the clare

Ans : (c) The function of inert gas in filament lamp is to minimize the effect of evaporation during services. It slows down the evaporation of the tungsten filament compared to operating it is a vacuum. This allows for greater temperatures and therefore greater efficiency with less reduction in filament life.

82. In which one of the following is flexible wire is not used?
(a) T.V.   (b) Table fan
(c) Table light   (d) cement factory

Ans : (d) Flexible wire is not used in cement factory. In cement factory solid wire is used.

83. The gas used in gas filed filament lamp
    (a) Helium   (b) Oxygen
    (c) Nitrogen   (d) Ozone

Ans : (c) The gas used in gas filled filament lamp is nitrogen. Nitrogen is used because it doesn't react with the hot filament.

84. The output of Tungsten filament lamp depends on
    (a) Size of lamp
    (b) Size of shell
    (c) Temperature of filament
    (d) All options are correct

Ans : (c) The output of Tungsten filament lamp depends on temperature of filament. Operating temperature of tungsten filament lamp is about 2200 ºC - 2500 ºC.

85. In arc welding the voltage on AC supply system in the range
    (a) 1000-1200 V   (b) 400-500 V
    (c) 200-250 V   (d) 70-100 V

Ans : (d) In arc welding the voltage on AC supply system is in the range of 70 – 100 volt, High voltage needed to start the arc and low voltage needed to maintain that voltage constant in arc welding. In this welding, electrode and metal has no contact. So pressure will not apply in this welding, It is also known as non pressure welding.
Note- Commission declares no correct answer.

86. Which of the following is not a welding accessory?
    (a) Electrode holder   (b) Hand screen
    (c) Cable   (d) Gloves

Ans : (c) In the given options cable is not a welding accessory. Whereas electrode holder, hand screen, gloves are the part of welding accessories.

87. The temperature inside a furnace is usually measured by
    (a) Mercury thermometer
    (b) Optical pyrometer
    (c) Alcohol thermometer
    (d) Any of the options is correct

Ans : (b) The temperature inside a furnace is usually measured by optical pyrometer. Because temperature inside furnace is very high (about 3000º C to 3500 ºC). It work on the principle of matching the brightness of an object to the brightness of the filament. It measures temperature without coming physical contact.

88. In electric resistance welding
    (a) The current required exceeds 100 A
    (b) The voltage required ranges from 4 to 12 V
    (c) The amount of power supplied to the weld usually ranges from 60 - 80 watts for each square mm of area
    (d) All options are correct

Ans : (d) In electric resistance welding, the current required exceeds 100A and voltage required ranges from 4 to 12. Electric resistance welding is a type of pressure welding. The amount of power supplied to the weld usually ranges from 60 w to 80 w for each square mm of area.

89. Which of the following is a trivalent?
    (a) Boron   (b) Aluminium
    (c) Indium   (d) All options are correct

Ans : (d) Boron, Aluminium, indium all elements are trivalent. They are used to develop P-type semiconductors. Trivalent impurities are of group 13 in periodic table. There impurities have electron deficiency. So they generate holes and deficiency of electrons is called acceptor ions.

90. Which of the following are immobile?
    (a) Electrons   (b) Holes
    (c) Ions   (d) None of these

Ans : (c) Ions are immobile. They are not able to move or fixed of ions i.e. positive or negative ions, whereas electrons and holes are mobile. Mobility of electron is higher than the mobility of holes.

91. In an RC coupled amplifier, low frequency response is improved with
    (a) lower R_1 (b) higher C_C
    (c) less gain   (d) more bias

Ans : (b) In an RC coupled amplifier, low frequency response is improved with higher C_C. It used the resistor and the capacitor which are not expensive so the cost is low. It offers a constant gain over a wide frequency band. It has constant gain over a wide frequency band. It has poor impedance matching because its output impedance is several times larger than the device, at its end terminal.

92. The direction of rotation of a DC shunt motor is reversed by..............
    (a) reversing armature connections
    (b) interchanging the armature and field connection
    (c) adding resistance to the field circuit
    (d) reversing supply connections

Ans : (a) The direction of rotation of a DC shunt motor is reversed by reversing armature connections or reversing the field winding connection simultaneously, It the direction of armature and field current reversed at same time, the motor will not change its direction of rotation.

93. Which of the following is a correct statement about a series motor?
    (a) Its field winding consists of thicker wire and less turns
    (b) It can run easily without load
    (c) It has an almost constant speed
    (d) It has poor torque

Ans : (a) In series motor, the field winding consist of thicker wire and less turns, because fields winding is connected in series with armature. It has low resistance so wire thickness is high and number of turns in less.

94. What is the characteristics of an ideal voltage amplifier with respect to the input and output impedance?

(a) Low input and high output impedance
(b) High input and low output impedance
(c) Low input and low output impedance
(d) High input and high output impedance

Ans : (b) Ideal voltage amplifier have high input impedance and low output impedance, and a fixed gain at all frequencies.

Low output impedance helps to reduce the voltage drop in the amplifier when connected to a load. The power loss due to load current and resistance shall be to a minimum for better efficiency.

95. **The percentage full load slip in a synchronous motor is**
    (a) 0.01   (b) 0.005
    (c) 1   (d) zero

Ans : (d) Full load slip in synchronous motor is zero because synchronous motor runs on synchronous speed at full load. Resulting rotor and stator flux both runs on synchronous speed. So the difference of their relative speed is zero.

$$S\% = \frac{N_s - N_r}{N_r} \times 100 \quad \text{Where } N_r = N_s$$

$$S\% = \frac{N_s - N_s}{N_r} \times 100 = 0$$

$$\boxed{\%\text{slip} = \frac{N_s - N_r}{N_s} \times 100} \quad \text{where} \quad \boxed{N_r = N_s}$$

N_s = synchronous speed in rpm
N_r = Rotor speed.

$$\boxed{\% \text{ slip} = \frac{N_s - N_r}{N_s} \times 100 = 0}$$

96. **In synchronous motor the armature current has higher values for**
    (a) high excitation only
    (b) low excitation only
    (c) both high excitation only and low excitation only
    (d) None of these

Ans : (c) In synchronous motor the armature current has higher values for both high excitation and low excitation. High excitation also increases stability in synchronous motor. When load increases at normal excitation, its power factor decreases but armature current increases.

97. **An unexcited single phase synchronous motor is called as**
    (a) universal motor   (b) repulsion motor
    (c) AC series motor   (d) reluctance motor

Ans : (d) An unexcited single phase synchronous motor is called as reluctance motor. Torque of reluctance motor depends on the position of rotor. Salient pole type rotor is used for reluctance torque. It works for high load. Starting of reluctance motor is as similar as induction motor and it runs on synchronous speed.

98. **A constant speed motor is**
    (a) dc shunt motor
    (b) synchronous motor

(c) induction motor
(d) d.c. compound motor

Ans : (b) Synchronous motor is a constant speed motor, because, despite the increase in load motor runs at the same synchronous speed. It has the ability to control the power factor. An over excited synchronous motor can have leading power factor and can be operated in parallel to induction motors and lagging power factor loads thereby improving the system power factor. Its not self start motor.

99. **In a synchronous motor of the back e.m.f. is approximately equal to the applied voltage, then**
    (a) the torque generated is maximum
    (b) the excitation is said to be hundred percent
    (c) the excitation is said to be zero percent
    (d) the motor is said to be fully loaded

Ans : (b) In a synchronous motor of the back e.m.f. is approximately equal to the applied voltage, then the excitation is said to be 100%, This condition happens on $E_b = V$.

100. **A synchronous motor can operate at.............**
    (a) leading power factor only
    (b) lagging power factor only
    (c) unity power factor only
    (d) lagging, leading and unity power factors

Ans : (d) A synchronous motor can operate at lagging, leading and unity power factors. It delivers reactive power on leading power factor and absorb reactive power on lagging power factor. In this electromagnetic power varies linearly with the voltage. Its speed is constant irrespective of the loads.

REASONING

101. **In the following question, select the related word pair from the given alternatives.**
    Car : Tyre :: ? : ?
    (a) House : Room   (b) Labour : Salary
    (c) Camera : Photo   (d) House : People

Ans : (a) Tyre is a part of car similarly room is the part of house.

102. **In the following question, select the related word from the given alternatives.**
    Triangle : Figure :: Car : ?
    (a) Vehicle   (b) Seat
    (c) Road   (d) White

Ans : (a) Triangle is the type of figure in the same way car is type of vehicle.

103. **In the following question, select the related word from the given alternatives.**
    Hour : Minute :: Kilometer : ?
    (a) Meter   (b) Gram
    (c) Litre   (d) Weight

Ans : (a) As that minute is a small unit of hour. Similarly meter is a small unit of kilometer.
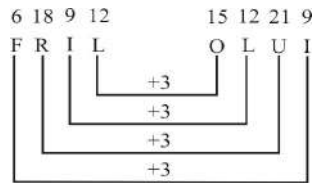
104. In the following question, select the related letters from the given alternatives.
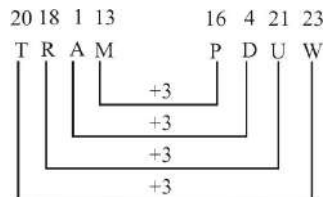
FRIL : OLUI :: TRAM : ?

(a) PKUW   (b) BDFW
(c) DPFV   (d) PDUW

Ans : (d)
Just as

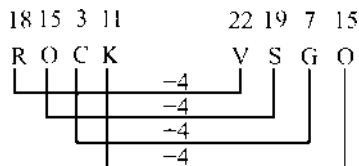Similarly

So $? \Rightarrow$ PDUW

105. In the following question, select the related letters from the given alternatives.

ROCK : VSGO :: BELT : ?
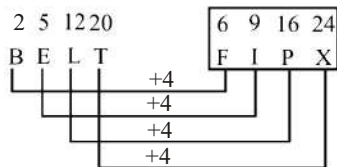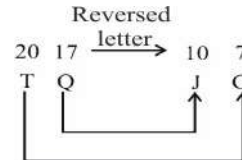
(a) AKLM   (b) FIPX
(c) FCXT   (d) ERPX

Ans : (b)
Just as

Note– Each letter of the first group is moved four steps forward to obtain the corresponding letter of the second group.
Similarly

So $? \Rightarrow$ FIPX

106. In the following question, select the related letters from the given alternatives.

LS : HO :: TQ : ?

(a) FM   (b) JG
(c) CL   (d) TF

Ans : (b)
Just as
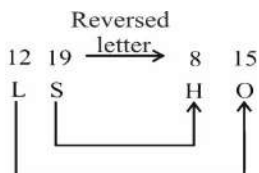
Similarly

So $? \Rightarrow$ JG

Note– If the sum of numeric value of letter in English alphabet is 27. Then these two letters are reversed to each other.

107. In the following question, select the related number from the given alternatives.

12 : 50 :: 18 : ?

(a) 40   (b) 70
(c) 80   (d) 60

Ans : (c) Just as
$$(12 \times 5) - 10, \Rightarrow 60 - 10 = 50$$
Similarly
$$(18 \times 5) - 10, \Rightarrow 90 - 10 = 80$$

108. In the following question, select the related number from the given alternatives.

11 : 121 :: 15 : ?

(a) 289   (b) 343
(c) 225   (d) 217

Ans : (c) Just as $(11)^2 = 121$
Similarly $(15)^2 = 225$

109. In the following question, select the related number from the given alternatives.

49 : 56 :: 81 : ?

(a) 92   (b) 88
(c) 76   (d) 84

Ans : (b) Just as $49 + 7 = 56$
Similarly $81 + 7 = 88$
So $? \Rightarrow 88$

110. In the following question, select the odd word from the given alternatives.

(a) Hand   (b) Legs
(c) Lungs   (d) Ear

Ans : (c) The hand, legs, Ear the external parts of body where as the lungs is the internal part of body. So, lungs is different from other alternatives.

111. In the following question, select the odd word from the given alternatives.

(a) Lizard   (b) Rabbit
(c) Snake   (d) Crocodile

Ans : (b) The lizard, snake and crocodile are the reptiles where as rabbit are the mammals. So, rabbit is the odd word from given alternatives.

112. In the following question, select the odd word from the given alternatives.

(a) Car   (b) Bus
(c) Truck   (d) Transport

Ans : (d) Car, Bus and Truck are all come under the transportation. So, transport is the odd word from the given alternatives.

113. In the following question, select the odd letters from the given alternatives.
(a) IFC   (b) LIF
(c) SPM   (d) GDZ

Ans : (d)

So GDZ are the odd letters from the given alternatives.

114. In the following question, select the odd letters from the given alternatives.
(a) LO   (b) HS
(c) IR   (d) CY

Ans : (d) The letters LO, SH and RI are reversed to each other. whereas CY is not reverse letter to each other.

115. In the following question, select the odd letters from the given alternatives.
(a) XSNI   (b) OJEY
(c) UPKF   (d) EZUP

Ans : (b)

So, OJEY are different from the given alternatives.

116. In the following question, select the odd number from the given alternatives.
(a) 10 – 101   (b) 12 – 145
(c) 24 – 577   (d) 26 – 675

Ans : (d) $(10)^2 + 1 \Rightarrow 100 + 1 = 101$
$(12)^2 + 1 \Rightarrow 144 + 1 = 145$
$(24)^2 + 1 \Rightarrow 576 + 1 = 577$
$(26)^2 + 1 \Rightarrow 676 + 1 \neq 675$
So, 675 are different from the given alternatives.

117. In the following question, select the odd number from the given alternatives.
(a) 23   (b) 37
(c) 41   (d) 51

Ans : (d) The number 23, 37 and 41 are indivisible where as 51 are divisible number. So, 51 are the odd number from the given alternatives.

118. In the following question, select the odd number from the given alternatives.
(a) 11 – 26   (b) 16 – 33
(c) 13 – 28   (d) 18 – 33

Ans : (b)

So, the option (b) (16–33) are different number from the given alternatives.

119. According to dictionary, which of the following word will come at second position?
(1) Easily   (2) Earmark
(3) Ear   (4) Ease
(5) Earthy
(a) Earmark   (b) Earthy
(c) Ease   (d) Easily

Ans : (a) According to dictionary, the position of the words are–
■ Ear
■ Ear mark   – 2nd position
■ Earthy
■ Ease
■ Easily
So, Earmark is the word will come at second position from given words.

120. From the given alternatives, according to dictionary, which word will come at LAST position?
(a) Opaque   (b) Ointment
(c) Orderly   (d) Ordinary

Ans : (d) According to dictionary their order is–
■ Ointment
■ Opaque
■ Orderly
■ Ordinary   – 4th position or last position.
So, ordinary is the last word of given word from dictionary

121. Arrange the given words in the sequence in which they occur in the dictionary.
(1) Outlook   (2) Outlet
(3) Outburst   (4) Ornament
(5) Outrageous
(a) 43215   (b) 34215
(c) 25341   (d) 52341

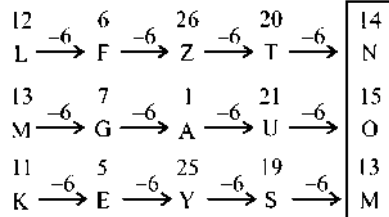**Ans : (a)** Arrangement of words according to the sequence in the dictionary are–
■ Ornament
■ Outburst
■ Outlet
■ Out look
■ Outrageous

122. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.

LMK, FGE, ZAY, TUS, ?
(a) BMQ   (b) SRB
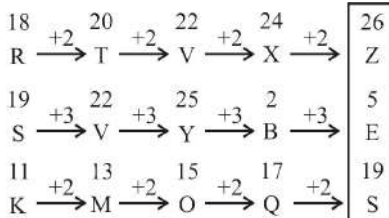(c) LZD   (d) NOM

Ans : (d)

So, ⇒ NOM is the ones that will complete the series.

123. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
RSK, TVM, VYO, XBQ, ?
(a) RGT   (b) YFA
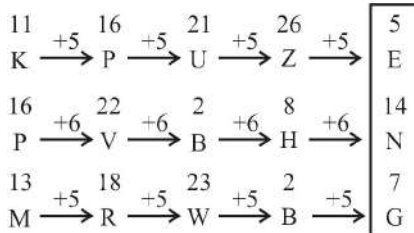(c) LQT   (d) ZES

Ans : (d)

So, ⇒ ZES is the ones that will complete the series.

124. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.
KPM, PVR, UBW, ZHB, ?
(a) LQU   (b) NGT
(c) ENG   (d) HIR

Ans : (c)

So, ⇒ ENG is the ones that will complete the series.

125. In the following question, select the missing number from the given alternatives.
35, 39, 48, 64, 89, ?
(a) 169   (b) 120
(c) 125   (d) 134

Ans : (c)
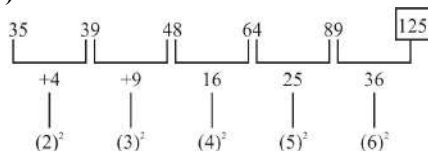
So, 125 is the missing number from the given alternatives.

126. In the following question, select the missing number from the given alternatives.
41, 13, 54, 67, 121, ?
(a) 143   (b) 188
(c) 194   (d) 168

Ans : (b) 41 + 13 = 54
       13 + 54 = 67
       54 + 67 = 121
       67 + 121 = 188
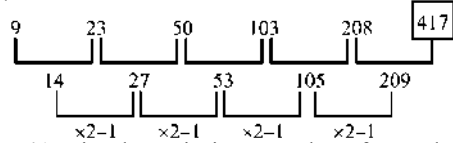   So ⇒ 188 is the missing number from the given alternatives.
Note– The sum of the previous two numbers is the next number.

127. In the following question, select the missing number from the given alternatives.
9, 23, 50, 103, 208, ?
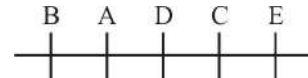(a) 323   (b) 411
(c) 417   (d) 431

Ans : (c)

So, 417 is the missing number from the given alternatives.

128. Five people are standing in a ticket booking line. A, C and D are standing together, D is between A and C. A is immediately behind B and E is immediately behind C. Who is standing second last in the line?
(a) C   (b) E
(c) D   (d) A
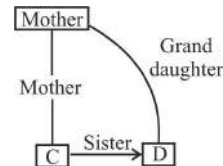
Ans : (a)
According to equation–

So, C is standing second last in the line.

129. At a family gathering C explained her relation with D by saying that D is the granddaughter of C's mother's mother. If C's mother has no siblings, then how is D related to C?
(a) Daughter   (b) Wife
(c) Sister   (d) Mother

Ans : (c)

So, D is the a sister of C

130. From the given alternative words select the word which cannot be formed using the letters of the given word.
CHAUVINIST
(a) chain   (b) acute
(c) stain   (d) china

Ans : (b) Acute is the word which cannot be formed using the letters of CHAUVINIST because the letter E is not present in the given word.

131. If CHATEAU is coded as DIBUFBV, then how will FOX be coded as?
(a) ULC   (b) ENW
(c) GPY   (d) GPZ

Ans : (c)
Just as CHATEAU is coded as DIBUFBV

Similarly FOX is coded as GPY

So $? \Rightarrow$ GPY

132. In the certain code language, 2579 means 'nice bow and arrow', 3457 means 'healthy and nice fruit' and '8721' means 'bow to nice king'. Find the code for 'bow'.
(a) 5   (b) 2
(c) 7   (d) 9

Ans : (b)

So,   bow = 2

133. In a certain code language, '+' represent '–', '–' represent '×', '×' represents '÷' and '÷' represents '+'. Find out the answer to the following question.
100 × 5 + 15 – 12 ÷ 6 = ?
(a) 513   (b) 71
(c) –31   (d) –154

Ans : (d) $+ = -, - = \times, \times = \div, \div = +$
     $100 \times 5 + 15 - 12 \div 6$ .... Equation.
By changing the mathematical expression and solving given equation.
     $100 \div 5 - 15 \times 12 + 6$
     $20 - 180 + 6$
     $26 - 180 = -154$

134. If 74% 36 = 2, 29 % 61 = 4 and 19 % 26 = 2 then find the value of 48 % 25 = ?
(a) 23   (b) 73
(c) 5   (d) 2

Ans : (c) $74\% \ 36 = 2$
     $= \quad (7 + 4) - (3 + 6)$
     $\Rightarrow \quad 11 - 9 = 2$
     $29\% \ 61 = 4$
     $(2 + 9) - (6 + 1)$
     $\Rightarrow \quad 11 - 7 = 4$
     $19\% \ 26 = 2$
     $(1 + 9) - (2 + 6)$
     $\Rightarrow \quad 10 - 8 = 2$
     $48\% \ 25$
     $(4 + 8) - (2 + 5)$
     $12 - 7 = 5$
So, the value of [48% 25 = 5]

135. If A $ B means A is daughter of B, A # B means A is brother of B and If A * B means A is father of B, then what does P $ Q * R # S mean?
(a) P is mother of S
(b) P is daughter of S
(c) P is sister of S
(d) P is mother's mother of S

Ans : (c)
     A $ B =   A is daughter of B
     A # B =   A is brother of B
     A * B =   A is father of B
     P $ Q * R # S......... Equation

So, P is sister of S.

136. Select the missing number from the given responses.

4	10	?
1	7	8
4	5	9

(a) 6   (b) 14
(c) 1   (d) 17

Ans : (b)
From the first row–
     $4 + 10 =$ 14
From the second row–
     $1 + 7 = 8$
From the third row–
     $4 + 5 = 9$
So, 14 is he missing number from the given responses

137. Which of the following terms follows the trend of the given list?
**AABAAAAA, ABAAAAAA, BAAAAAAA, AAAAAAAB, AAAAAABA, ...**

(a) AAAAABAA   (b) AAAABAAA
(c) AAABAAAA   (d) AABAAAAA

Ans : (a) The terms AABAAAAA follows the trend of given list. The letter B move one place from right to left in each terms.

138. **A plane takes off and flies 30 km South. Then it turns East and flies 10 km, then it turns to its left and flies 25 km, then it turns and flies 10 km towards West. Where is the plane now with respect to its starting position?**
(a) 5 km South   (b) 5 km North
(c) 55 km South   (d) 55 km North

Ans : (a)

$$\Rightarrow AE = 30 - 25 = 5 \text{ km}$$
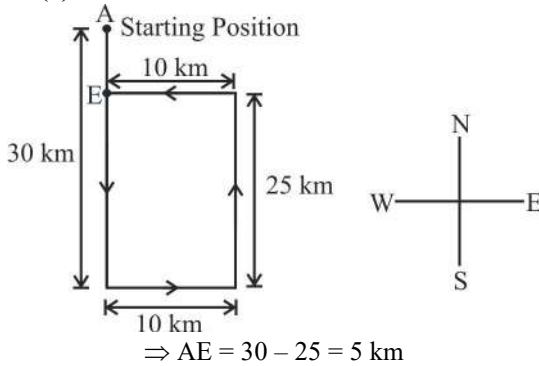
So, 5 km south is the plane now with respect to its starting position.

139. **Two motorcycle riders start from the same point. Rider A goes 15 km North then turns to his right and rides for another 8 km. Rider B goes 9 km West, then turns North and rides for 4 km and then turns to his right and rides 17 km. Where is rider A with respect to rider B?**
(a) 11 km South   (b) 11 km North
(c) 19 km North   (d) 19 km South

Ans : (b)
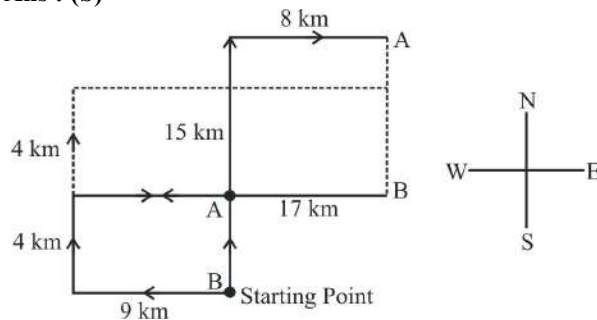
So, the rider A is (15 – 4) = 11 km North with respect to rider B.

140. **In the question two statements are given, followed by two conclusions, I and II. You have to consider the statements to be true even if it seems to be at variance from commonly known facts. You have to decide which of the given conclusions, if any follows from the given statements.**
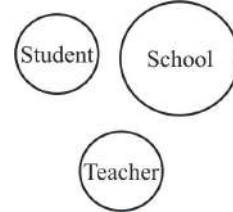**Statement I : No students are scholars**
Statement II : No students are teachers

Conclusion I : Some teachers are scholars
Conclusion II : All scholars are teachers
(a) Only conclusion I follows
(b) Only conclusion II follows
(c) Both conclusions I and II follow
(d) Neither conclusion I nor conclusion II follows

Ans : (d)

Conclusion I : Some teacher are scholars   (×)
Conclusion II : All scholars are teachers   (×)
So, neither conclusion I nor conclusion

141. **In the question three statements are given, followed by three conclusions, I, II and III. You have to consider the statements to be true even if it seems to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follows from the given statements.**
Statement I : All cotton is cloth
Statement II : All cotton is shirts
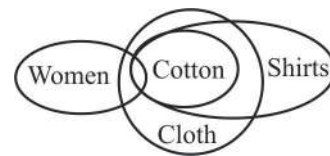**Statement III : Some cotton is woven**
Conclusion I : Some woven is shirts
Conclusion II : Some cloth is woven
Conclusion III : All cloth is shirts
(a) Only conclusion I follows
(b) Only conclusion II follows
(c) Only conclusions I and II follow
(d) All conclusions I, II and III follow

Ans : (c)

Conclusion I : Some women is shirts   (√)
Conclusion II : Some cloth is women   (√)
Conclusion III : All cloth is shirts   (×)
So, only conclusion I and II follow.

142. **Which of the following cube in the answer figure cannot be made based on the unfolded cube in the question figure?**