ESE 2021 (Paper-1)

General Studies & Engineering Aptitude

18th July   **SET-C**

Questions with Detailed Solutions

1. Which one of the following rules is NOT used for identifying an out-of-control process?
    A. A process is assumed to be out-of-control if a single point plots outside the control limits.
    B. A process is assumed to be out-of-control if there is a run of six or more consecutive points steadily increasing or decreasing.
    C. A process is assumed to be out-of-control if nine or more consecutive points fall to one side of the centre line.
    D. A process is assumed to be out-of-control if two or more consecutive points fall beyond the 1σ limit on the same side of the centre line.

Ans. D

Sol. A process is said to be out of control if:
    - One or more data points fall outside the control limits
    - Seven consecutive data points increasing or decreasing
    - Eight consecutive data points are on one side of average
    - Fourteen consecutive data points alternating up and down
    - Two data points, out of three consecutive data points, are on the same side of the average in zone A or beyond
    - Four data points, out of five consecutive data points, are on the same side of the average in zone B or beyond
    - Fifteen consecutive data points are within zone C (above and below the average)

2. Which one of the following is NOT a major quality control method?
    A. Inspection
    B. Testing
    C. Loading
    D. Sampling

Ans. C

Sol. Loading - Assigning of jobs to work centres and to different machines in the work centres is termed as loading. Hence, loading is not a major quality control method.

3. Which one of the following is the responsiveness to business issues in commercial performance ?
    A. Frequency of over shipments
    B. Quotations
    C. Timely reconciliation of cumulative shipments
   D. Timely supplier response to problems

Ans. D

Sol. Responsiveness is an organization's ability to identify and effectively adapt to the continuous change in their industry and in their customers' preferences. Companies who effectively adapt to change are better able to manage disruption and consistently meet their customers' expectations.

4. Which one of the following is NOT a component of total variability of measured observations?

A. Variation between operators

B. Variability due to operators

C. Variability between parts dimensions

D. Variation due to interaction between operators and parts

Ans. D

Sol.
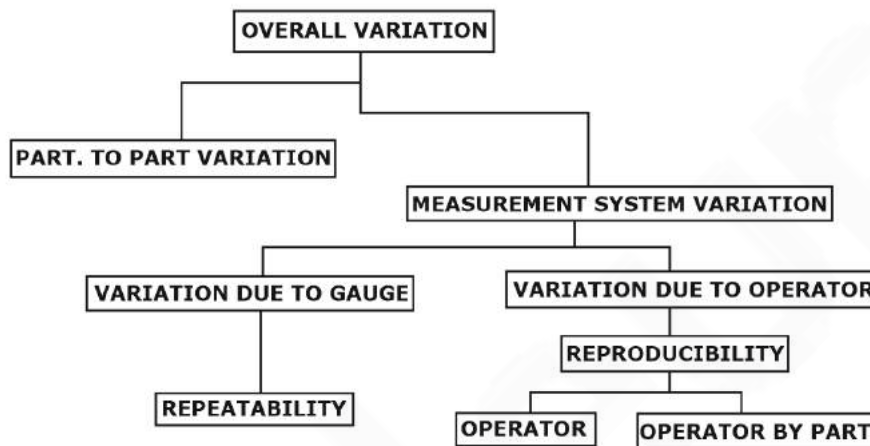
Hence, we see that part to part variation is not a component of total variability of measured observations.

5. Which one of the following unique characteristics of the construction process makes TQM difficult to implement?

A. The construction process is relatively short in duration

B. A low percentage of the labour at a construction project only work for the construction firm for a short time period

C. Project owners take a long term view to control projects

D. Construction projects are multiple, each project being somewhat same

Ans. B

Sol. There are many obstacles during the implementation of TOM, such as:

1. Lack of strategic planning related to changes necessary for various planning. processes and prod

2. Poor customer focus.

3. Lack of communication among intra-departments of a company.

4. Lack of employee empowerment in organisation.

5. More emphasis given to financial results in short-term.

6 internal politics existing in the organisation.

7 Lack of strong motivation in employees.

8. Lack of commitment from top management.

From the above statements, we can conclude that if the employees leave an organisation within a short period of time, then implementation of TQM will be difficult, like in the case of construction firms.

6. Rearrange the following steps involved in construction of pareto diagram in the proper order.

   1. Determine how relative importance is to be judged.

   2. Decide on the data categorization system.

   3. Rank the categories from most important to least important.

   4. Plot a bar graph.

   5. Compute the cumulative frequency of the data categories in their chosen order.

   Select the correct answer using the code given below:

   A. 1, 3, 2, 4, 5

   B. 2, 3, 1, 5, 4

   C. 2, 1, 3, 5, 4

   D. 1, 2, 3, 4, 5

Ans. A

Sol. PARETO CHART PROCEDURE:

   1. Decide what categories you will use to group items.

   2. Decide what measurement is appropriate. Common measurements are frequency, quantity, cost and time.

   3. Decide what period of time the Pareto chart will cover: One work cycle? One full day? A week?

   4. Collect the data, recording the category each time, or assemble data that already exist.

   5. Subtotal the measurements for each category.

   6. Determine the appropriate scale for the measurements you have collected.

   7. Construct and label bars for each category. Place the tallest at the far left, then the next tallest to its right, and so on.

   Note: Steps 8 and 9 are optional but are useful for analysis and communication

   8. Calculate the percentage for each category: the subtotal for that category divided by the total for all categories. Draw a right vertical axis and label it with percentages. Be sure the two scales match.

   9. Calculate and draw cumulative sums: add the subtotals for the first and second categories and place a dot above the second bar indicating that sum. To that sum add the subtotal for the third category and place a dot above the third bar for that new sum. Continue the process for all the bars. Connect the dots, starting at the top of the first bar. The last dot should reach 100 % on the right scale.

Directions:

Each of the next **Four (04)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

B. Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)

C. Statement (I) is true but Statement (II) is false

D. Statement (I) is false but Statement (II) is true

7. **Statement (I):** Issue of shares is the most common method especially to raise long-term funds.

    Statement (II): The equity shareholders are residual owners who have restricted claim on income as dividend.

    A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

    B. Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)

    C. Statement (I) is true but Statement (II) is false

    D. Statement (I) is false but Statement (II) is true

Ans. B

Sol.

- ➢ Companies issue shares to raise money from investors who tend to invest their money.
- ➢ It is the most common method to raise money on a long term basis.
- ➢ Shareholders Get a stake in the company's equity and a share in its profits, in the form of dividends.

8. **Statement (I):** The slip mode of deformation is the common mode in only one crystal at ambient and elevated temperature.

    Statement (II): A slip plane and a slip direction that lies on it together constitute a slip system.

    A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

    B. Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)

    C. Statement (I) is true but Statement (II) is false

    D. Statement (I) is false but Statement (II) is true

Ans. B

Sol. Statement 1 & Statement 2 are true but Statement 2 is not the correct explanation of the Statement 1 as the slip system does not confirm the reason for slip mode of deformation being common in only one crystal.

9. **Statement (I):** Major e-Governance projects bear fruit only when application of IT is preceded by process re-engineering.

Statement (II): Initiatives which save the citizens' time, money and effort are able to succeed even when back-end computerization is not done.

A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

B. Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)

C. Statement (I) is true but Statement (II) is false

D. Statement (I) is false but Statement (II) is true

Ans. D

Sol. e-governance can be defined as the usage of ICT by the government to provide and facilitate government.

Services, exchange of information communication transactions and integration of various stand-alone systems and services.

Within the government system there is large scale processing of information and decision making. G2G initiatives help in making internal government process more efficient and saves citizens time, money and efforts are able to succeed even when back-end computerization is not done.

10. **Statement (I):** Moral pluralists maintain that there are moral truths, but they do not form a body of coherent and consistent truths in the way that one finds in science or mathematics.

Statement (II): Moral truth are real, but partial.

A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

B. Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)

C. Statement (I) is true but Statement (II) is false

D. Statement (I) is false but Statement (II) is true

Ans. A

Sol. Moral pluralists believe in error theory i.e., there is no absolute moral truth, everyone decdes right and wrong on basis their convenience.

Key statement there is your truth, my truth & real truth.

11. The surface are of that portion of the surface $z = \sqrt{4 - x^2}$ that lies above the rectangle R in the xy-plane whose co-ordinates satisfy $0 \le x \le 1$ and $0 \le y \le 4$ is equal to

A. $4 - \pi$

B. $\frac{3}{4}\pi^2$

C. $\frac{\sqrt{3}}{5}\pi$

D. $\frac{4}{3}\pi$

Ans. D

Sol.

$Z = \sqrt{4 - x^2}$

$\dfrac{dz}{dx} = \dfrac{1}{2\sqrt{4 - x^2}}(-2x) = \dfrac{-x}{\sqrt{4 - x^2}}$

$\left(\dfrac{dz}{dx}\right)^2 = \dfrac{x^2}{4 - x^2}$

$1 + \left(\dfrac{dz}{dx}\right)^2 = 1 + \dfrac{x^2}{4 - x^2} = \dfrac{4}{4 - x^2}$

$\sqrt{1 + \left(\dfrac{dz}{dx}\right)^2} = \dfrac{2}{\sqrt{4 - x^2}}$

& given $Z = \sqrt{4 - x^2}$

$\Rightarrow x^2 + z^2 = 4$

Which is a circle on xz-plane

Length of area of $Z = \sqrt{4 - x^2}$

Between $x = 0$ and $x = 1$ on xz-plane

$P = \int\limits_{0}^{1} \sqrt{1 + \left(\dfrac{dz}{dx}\right)^2} \cdot dx$

And, surface area of $Z = \sqrt{4 - x^2}$

from $y = 0$ to $y = 4$

$\Rightarrow S = \int\limits_{y=0}^{4} p \cdot dy$

$\Rightarrow S = \int\limits_{y=0}^{4} \int\limits_{x=0}^{1} \sqrt{1 + \left(\dfrac{dz}{dx}\right)^2} \cdot dx \cdot dy$

$\Rightarrow S = \int\limits_{y=0}^{4} \int\limits_{x=0}^{1} \dfrac{2}{\sqrt{4 - x^2}} dx \cdot dy$

$\Rightarrow S = 2 \int\limits_{y=0}^{4} \left[\sin^{-1}\left(\dfrac{x}{2}\right) \right]_{0}^{1} dy = 2\int\limits_{0}^{4} \sin^{-1}\left(\dfrac{1}{2}\right) dy$

$S = 2 \dfrac{\pi}{6} \int\limits_{0}^{4} I \cdot dy = \dfrac{2\pi}{6} \times 4 = \dfrac{4\pi}{3}$

12. The value of y at x = 0.1 to five places of decimals, by Taylor's series method, given that $\frac{dy}{dx} = x^2y - 1, y(0) = 1$, is

A. 0.68281

B. 0.81122

C. 0.90033

D. 0.70127

Ans. C

Sol. Acc. to Taylor series

$$y(x) = y(0) + xy'(0) + \frac{x^2}{2!}y''(0) + \frac{x^2}{3!}y'''(0) + \frac{x^4}{4!}y''''(0)$$

$y(0) = 1 \rightarrow$ Given in question

$$y'(0) = y'(x)\big|_{x=0} = x^2y - 1\big|_{x=0} = -1$$

$$y''(x) = \frac{d}{dx}[y'(x)] = \frac{d}{dx}[x^2y - 1]$$

$$= 2xy + x^2 \cdot \frac{dy}{dx}$$

$$y''(x)\big|_{x=0} = y''(0) = 2(0)y + (0)\cdot\frac{dy}{dx} = 0 \qquad \left[\because \frac{dy}{dx}\big|_{x=0} = -1\right]$$

$$y'''(x) = \frac{d}{dx}(y''(x))$$

$$= \frac{d}{dx}\left[2xy + x^2 \cdot \frac{dy}{dx}\right]$$

$$= 2x\frac{dy}{dx} + 2y + 2x\frac{dy}{dx} + x^2\frac{d^2y}{dx^2}$$

$$y'''(x)\big|_{x=0} = 2(0)\frac{dy}{dx} + 2y + 0(0)\frac{dy}{dx} + (0)^2\frac{d^2y}{dx^2}$$

$$= 2 \qquad \left[\because \frac{dy}{dx}\big|_{x=0} = -1, y\big|_{x=0} = 1, \frac{d^2y}{dx^2}\big|_{x=0} = 0\right]$$

$$y(x) = 1 + x(-1) + \frac{x^2}{2!}(0) + \frac{x^2}{3!}(+2)$$

$$= 1 + (-x) + \frac{x^3}{3}$$

$$y(0.1) = 1 - 0.1 + \frac{(0.1)^3}{3} = 0.90033$$

13. In which one of the following projection types, the object is kept in such a way that its three mutual perpendicular edges make equal angles with the plane of projection and the object stands on one of its corners?

A. Non-Isometric projection

B. Oblique projection

C. Isometric projection

D. Point projection

Ans. C

Sol. A) In non-isometric such as oblique (in which L and height are perpendiculars whereas breath axis is not perpendicular, shown in Fig 2), their axes are not equally inclined, Multiview (we can have only two perpendicular edges only, shown in Fig 1) axes are perpendicular but only two edges present.

B) in oblique projection, Length and height are perpendiculars, whereas the breath axis is not perpendicular (See fig 2).

C) In isometric, the object orientation is made so that the angle between their axes is 120° with each other. To get this, all the faces of an object kept in a parallelepiped element should be equally inclined to the principal plane (i.e. 45°). In this case, the parallelopiped objects rest in their corner. (Fig 3)

D) perspective projection is a point projection; in this projection, the angles are different based on the position of the observer and object. Here the angles are not the same. (Fig 4)
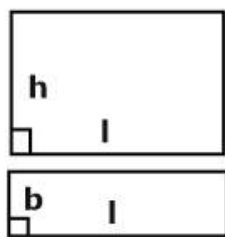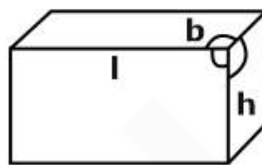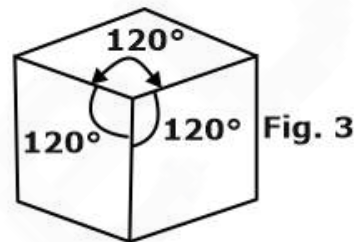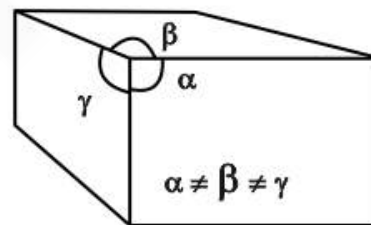

Fig. 1   Fig. 2   Fig. 3

Fig. 4

14. The creative design routes are practiced by adopting following steps:

    1. Concentration   2. Illumination

    3. Preparation   4. Verification

    5. Incubation

    Arrange the above steps in correct sequence:

    A. 2, 1, 5, 2, 4   B. 3, 5, 2, 1, 4

    C. 3, 2, 1, 5, 4   D. 3, 1, 2, 5, 4

Ans. B

Sol. The stages in the Creative design process:

1. **Preparation stage**: As you begin the creative journey, the first stage involves prep work and idea generation. This is when you gather materials and conduct research that could spark an interesting idea. Brainstorm and let your mind wander, or write in a journal to foster divergent thinking; this will help you consider all possible approaches to building out your idea. In this first part of the process, your brain uses its memory bank to draw on knowledge and past experiences to generate original ideas.

2. **Incubation stage**: When you have finished actively thinking about your idea, the second stage is where you let it go. Part of creative thinking is taking a step away from your idea before sitting down to flesh it out. You might work on another project or take a break from the creative process altogether—regardless, you are not consciously trying to work on your idea. Walking away from your idea might seem counterproductive, but it's an important stage of the process. During this time, your story or song or problem is incubating in the back of your mind.

3. **Illumination stage**: Sometimes called the insight stage, illumination is when the "aha" moment happens. The light bulb clicks on as spontaneous new connections are formed, and all of that material you've gathered comes together to present the solution to your problem. In this third stage, the answer to your creative quest strikes you. For example, you overcome writer's block by figuring out the ending to your story. It can take you by surprise, but after the incubation stage, an idea has emerged.

4. **Evaluation (concentration) stage**: During this stage, you consider the validity of your idea and weigh it against alternatives. This is also a time of reflection when you look back at your initial concept or problem to see if your solution aligns with your initial vision. Business professionals <u>might do market research to test the viability of the idea</u>. During this phase, you might go back to the drawing board, or you might forge on, confident in what you've come up with.

5. **Verification stage**: This is the final stage of the creative process. It's when the hard work happens. Your creative product might be a physical object, an advertising campaign, a song, a novel, an architectural design—any item or object that you set out to create, propelled by that initial idea that popped into your head. Now, you finalize your design, bring your idea to life, and share it with the world.

15. Points to be remembered while dimensioning:

1. Dimensions are to be placed on the view which clearly express the relevant features.

2. Once dimension is marked in one view, it should not be repeated in another view.

3. Dimensions are to be drawn from hidden lines.

4. Dimensions should be given from the base line or centre line of a hole.

Which of the above statements are correct?

A. 1, 2 and 3 only   B. 1, 2 and 4 only

C. 1, 3 and 4 only   D. 2, 3 and 4 only

Ans. B

Sol. 1. the drawings are either actual size or scale. The elements are proportional. So the dimensions are also relative to the size (features). **This statement is also TRUE.**

2. dimensions should not be repetitive (i.e. in Multiview projection, length information present in front view, and top view, so only in one place should we place). **This statement is TRUE**.

3. dimensions are provided to both actual and hidden. Only drawing from hidden lines (i.e. invisible elements) is not correct. **This statement is NOT TRUE.**

4. for circular holes (in the view where it appears as a rectangle), diameter is mentioned concerning the baseline, and radius can be given concerning the axis (i.e. centre) line. **This statement is also TRUE.**

16. The design of highway interchanges involves the application of the geometry of

A. Circle arcs   B. Semi-ellipse

C. Hyperbola   D. Semi-circle

Ans. C

Sol. To avoid slipping due to the centrifugal forces, the radius of curvature increases on interchanges. Hence a cloverleaf is provided that involves the application of hyperbolas.

17. On a multi view drawing a visible or invisible line represents the following:

1. Intersection of two surfaces

2. Edge view of a surface

3. Limiting elements of a surface

Which of the above points are correct?

A. 1 and 2 only   B. 2 and 3 only

C. 1 and 3 only   D. 1, 2 and 3

Ans. D

Sol. **Multiview Drawings**

Objectives

After completing this chapter, you will be able to:

1. Explain orthographic and Multiview projection.

2. Identify frontal, horizontal, and profile planes.

3. Identify the six principal views and the three space dimensions.

4. Apply standard line practices to Multiview drawings.

5. Create a Multiview drawing using hand tools or CAD.

6. Identify normal, inclined, and oblique planes in Multiview drawings.

7. Represent lines, curves, surfaces, holes, fillets, rounds, chamfers, runouts, and ellipses in Multiview drawings.

8. Apply visualization by solids and surfaces to Multiview drawings.

9. Explain the importance of Multiview drawings.

10. Identify limiting elements, hidden features, and intersections of two planes in Multiview drawings.

18. On a view showing assembled parts, section lines on adjacent pieces are drawn in

   A. Same directions usually at an angle of 90º

   B. Opposite directions usually at an angle of 45º

   C. Opposite directions usually at an angle of 30º

   D. Same directions usually at an angle of 60º

Ans. B

Sol. To know the inner features of an object, it can be cut (or sectioned) with an imaginary cutting plane.

The sectioned portion can be represented with hatching lines.

The following hatching lines can be considered for representing sectioned portion.

1. At the sectioned part, only one material is present; hatching lines should be parallel to each other, equally spaced and 45° up forward (/) to the XY line (with reference line, i.e. XY line)

2. At the sectioned part, two parts are present, then

(a) one object can be represented with hatching lines that should be parallel to each other, equally spaced and 45° up forward (/) to the XY line (with reference line, i.e. XY line)

(b) another object can be represented with hatching lines that should be parallel to each other, equally spaced and 45° down forward (\) to the XY line (with reference line, i.e. XY line)

3. When more number elements are present and have the same common line, then only we can choose 30° or 60° (for 3rd, 4th, 5th and soon)

19. Oblique drawing has the following advantage over isometric drawing:

   A. Distortion can be increased by foreshortening measurements along the receding axis

   B. A greater choice is permitted in orthographic top view

   C. Circular or irregular outlines on the front face show in their true shape

   D. Oblique drawing is often less flexible

Ans. C

Sol. Deming's deadly diseases involve:

1. Lack of constancy of purpose

2. Emphasis on short-term profits

3. Personal review systems including evaluation by performance, meditating or annual review

4. Mobility of management

5. Running a company on visible figures alone rather than 'invisible' or non-numerical data

6. Excessive medical costs

7. Excessive liability costs

20. Most of Deming's deadly diseases involve

A. Immobility of management

B. A long term orientation

C. A lack of understanding of variation

D. High degree of constancy of purpose

Ans. C

Sol. Deming's deadly diseases involve:

1. Lack of constancy of purpose

2. Emphasis on short-term profits

3. Personal review systems including evaluation by performance, merit rating or annual review

4. Mobility of management

5. Running a company on visible figures alone rather than 'invisible' or non-numerical data

6. Excessive medical costs

7. Excessive liability cost.

21. suppose that a book of 600 pages contains 40 printing mistakes. Assume that these errors are randomly distributed throughout the book and x, the number of errors per pages has a Poisson distribution. What is the probability that 10 pages selected at random will be free of errors?

A. $\frac{1}{3}e^{-1}$

B. $2e^{-\frac{1}{3}}$

C. $e^{-\frac{2}{3}}$

D. $\frac{1}{3}e^{-2}$

Ans. C

Sol. Let P be the probability of printing mistakes

Given, $P = \frac{40}{600}$ & $n = 10$

mean, $\lambda = np \approx 10 \times \frac{40}{600} = \frac{2}{3}$

$\lambda = \frac{2}{3}$

According to Poisson's distribution,

Probability of error free pages, $P(x) = \frac{\lambda^x \cdot e^{-\lambda}}{x!}$

for error-free page, x = 0

$P(0) = \frac{\lambda^0 \cdot e^{-\lambda}}{0!} = e^{-2/3}$

22. The highest Eigen value of the 2×2 matrix $\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ is

    A. −1   B. −5

    C. 5   D. 1

Ans. C

Sol. $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$

$|A - \lambda I| = 0$

$\begin{vmatrix} 1-\lambda & 2 \\ 4 & 3-\lambda \end{vmatrix} = 0$

$(1 - \lambda)(3 - \lambda) - 8 = 0$

$\lambda^2 - 4\lambda - 5 = 0$

$(\lambda - 5)(\lambda + 1) = 0$

$\lambda = 5, \lambda = -1$

23. If $\Delta = \begin{vmatrix} p & p^2(p^3 - 1) \\ q & q^2(q^3 - 1) \\ r & r^2(r^3 - 1) \end{vmatrix} = 0$, in which p, q, r are different. The value of pqr is

    A. 3   B. 1

    C. 2.5   D. 3.5

Ans. B

Sol.

$$\Delta = \begin{vmatrix} p & p^2 & p^3 - 1 \\ q & q^2 & q^3 - 1 \\ r & r^2 & r^3 - 1 \end{vmatrix} = 0$$

$$= \begin{vmatrix} p & p^2 & p^3 \\ q & q^2 & q^3 \\ r & r^2 & r^3 \end{vmatrix} - \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} = 0$$

$$p.q.r \begin{vmatrix} 1 & p & p^2 \\ 1 & q & q^2 \\ 1 & r & r^2 \end{vmatrix} - \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} = 0$$

$C_1 \leftrightarrow C_3$

$$= -p.q.r \begin{vmatrix} p^2 & p & 1 \\ q^2 & q & 1 \\ r^2 & r & 1 \end{vmatrix} - \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} = 0$$

$C_1 \leftrightarrow C_2$

$$\Rightarrow pqr \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} - \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} = 0$$

$$\Rightarrow (pqr - 1) \begin{vmatrix} p & p^2 & 1 \\ q & q^2 & 1 \\ r & r^2 & 1 \end{vmatrix} = 0$$

$$\Rightarrow pqr - 1 = 0 \qquad \boxed{pqr = 1}$$

24. If $A = \begin{bmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 6 \end{bmatrix}$, then the ran of the matrix A is

A. 2

B. 5

C. 4

D. 3

Ans. A

Sol.

$$A = \begin{vmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 6 \end{vmatrix}$$

$R_2 \rightarrow R_2 + 2R_1, \; R_3 \rightarrow R_3 + 3R_1, \; R_4 \rightarrow R_4 + 5R_1$

$$A = \begin{vmatrix} -1 & 2 & 3 & -2 \\ 0 & -1 & 7 & -2 \\ 0 & -2 & 14 & -4 \\ 0 & -2 & 14 & -4 \end{vmatrix}$$

$R_3 \rightarrow R_3 - 2R_2, \quad R_4 \rightarrow R_4 - 2R_2$

$$A = \begin{vmatrix} -1 & 2 & 3 & -2 \\ 0 & -1 & 7 & -4 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

Rank (A) = 2

25. If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$, then which one of the following is correct?

A. $A^3 - 3A^2 - 4A + 11I = 0$

B. $A^3 - 4A^2 - 3A + 11I = 0$

C. $A^3 - 4A^2 - 3A + 11I = 0$

D. $A^3 - 3A^2 + 4A + 11I = 0$

Ans. B

Sol.

$$A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$$

$\rightarrow |A - \lambda I| = 0$

$$\begin{vmatrix} 1-\lambda & 3 & 2 \\ 2 & -\lambda & -1 \\ 1 & 2 & 3-\lambda \end{vmatrix} = 0$$

$(1 - \lambda)(\lambda^2 - 3\lambda + 2) - 21 + 6\lambda + 8 + 2\lambda = 0$

$\lambda^2 - 3\lambda + 2 - \lambda^3 + 3\lambda^2 - 2\lambda - 13 + 8\lambda = 0$

$-\lambda^3 + 4\lambda^2 + 3\lambda - 11 = 0$

$A^3 - 4A^2 - 3A + 11 I = 0$

26. The Maclaurin's series expansion of $e^{\sin x}$ is

A. $1 + x - \dfrac{x^2}{2} + \dfrac{x^4}{12} - \cdots$

B. $1 - x + \dfrac{x^2}{2} - \dfrac{x^4}{8} + \cdots$

C. $1 + x + \dfrac{x^2}{2} - \dfrac{x^4}{8} + \cdots$

D. $1 + x + \dfrac{x^2}{2} - \dfrac{x^4}{12} + \cdots$

Ans. C

Sol. Given $f(x) = e^{\sin x}$

Acc. to Maclaurian's series-

$$f(x) = f(0) + xf'(0) + \frac{x^2}{2!}f''(0) + \frac{x^3}{3!}f'''(0) + \frac{x^4}{4!}f''''(0)$$

$$f(x)\big|_{x=0} = f(0) = e^{\sin(0)} = 1$$

$$f'(x)\big|_{x=0} = f'(0) = e^{\sin x}.\cos x\big|_{x=0}$$

$$= e^{\sin(0)}.\cos(0) = 1$$

$$f''(x) = \frac{d}{dx}(f'(x)) = \frac{d}{dx}\left(e^{\sin x}.\cos x\right)$$

$$= e^{\sin x}(-\sin x) + e^{\sin x}.\cos^2 x$$

$$f''(x)\big|_{x=0} = f''(0) = e^{\sin 0}(-\sin(0)) + e^{\sin(0)}.\cos^2(0)$$

$$f'''(x) = \frac{d}{dx}(f''(x))$$

$$= \frac{d}{dx}\left[e^{\sin x}\left(\cos^2 x - \sin x\right)\right]$$

$$= e^{\sin x}\left[2\cos x(-\sin x) - \cos x\right] + e^{\sin x}.\cos x\left[\cos^2 x - \sin x\right]$$

$$f'''(x)|_{x=0} = f'''(0)$$

$$= e^{\sin(0)}\left[2\cos(0)(-\sin(0)) - \cos(0)\right] + e^{\sin(0)}\cos(0)\left[\cos^2(0) - \sin(0)\right]$$

$$= -1 + 1 = 0$$

$$f^{iv}(x) = \frac{d}{dx}\left[f'''(x)\right]$$

$$= \frac{d}{dx}\left[e^{\sin x}(-\sin 2x - \cos x) + e^{\sin x}\left[\cos^3 x - \frac{\sin 2x}{2}\right]\right]$$

$$= e^{\sin x}\left[-2\cos 2x + \sin x\right] + e^{\sin x}\cos x\left[-\sin 2x - \cos x\right]$$

$$\quad + e^{\sin x}\left[3\cos^2 x(-\sin x) - \cos 2x\right] + e^{\sin x}\cos x\left[\cos^3 x - \frac{\sin 2x}{2}\right]$$

$$f^{iv}(x)|_{x=0} = f^{iv}(0)$$

$$= e^{\sin 0}\left[-2\cos 2(0) + \sin(0)\right] + e^{\sin 0}\cos(0)\left[-\sin 2(0) - \cos(0)\right]$$

$$\quad + e^{\sin(0)}\left[3\cos^2(0)(-\sin(0)) - \cos 2(0)\right] + e^{\sin(0)}\cos(0)\left[\cos^3(0) - \frac{\sin 2(0)}{2}\right]$$

$$= (-2) + (-1) + (-1) + 1$$

$$= -3$$

Hence,

$$f(x) = 1 + x + \frac{x^2}{2} + \frac{x^3}{6}(0) + \frac{x^4}{24}(-3)$$

$$= 1 + x + \frac{x^2}{2} - \frac{x^4}{8}$$

27. The real root of $x^3 + x^2 + 3x + 4 = 0$ correct to four decimal places, obtained using Newton Raphson method is

A. −1.3334   B. 1.3221

C. −1.2229   D. 1.2929

Ans. C

Sol. f(x) = $x^3 + x^2 + 3x + 4 = 0$

f'(x) = $3x^3 + 2x + 3$

f(0) = 4

f(−2) = -6

f(−1) = 1

f(−1.5) = −13/8

f(−1.3) = −0.407

f(−1.4) = −0.984

f(−1.2) = 0.1122

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \qquad x_0 = -1.2$$

$$n = D \qquad x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}$$

$$x_1 = -1.2 - \frac{0.112}{4.92}$$

$$x_1 = -1.2228$$

28. The value of $\int_0^6 \frac{dx}{1+x^2}$ by Simpson's 1/3 rule is

A. 1.3111   B. 1.3941

C. 1.3735   D. 1.3663

Ans. D

Sol. By Simpson's 1/3 rule

$$\int_a^b f(x)dx = \frac{r}{3} [f(x_0) + 4 [f(x_1) + f(x_3) + \dots f(x_{n-1})] + 2[f(x_2) + f(x_4) + \dots f_{(xn-2)}] + f(x_n)]$$

$$\int_0^6 \frac{dx}{1+x^2} \Rightarrow f(x) = \frac{1}{1+x^2}$$

a = 0, b = 6, n = 6 , $h = \frac{b-a}{n} = \frac{6-0}{6} = 1$

$f(x_0) = 1$ $\quad\quad\quad$ $f(x_4) = 1/17$

$f(x_1) = 1/2$ $\quad\quad\quad$ $f(x_5) = 1/26$

$f(x_2) = 1/5$ $\quad\quad\quad$ $f(x_6) = 1/37$

$f(x_3) = 1/10$

$$\Rightarrow \int_0^6 \frac{1}{1+x^2}\,dx = \frac{h}{3}[f(x_0) + f(x_6) + 4[f(x_1) + f(x_3) + f(x_5)] + 2[f(x_2) + f(x_4)]$$

$$= \frac{1}{3}\left[\left(1 + \frac{1}{37}\right) + 4\left[\frac{1}{2} + \frac{1}{10} + \frac{1}{26}\right] + 2\left[\frac{1}{5} + \frac{1}{17}\right]\right]$$

$$= \frac{1}{3}\left[1.027 + 2.554 + 0.5176\right]$$

$$= 1.3662$$

29. The value of $\sum_1^n \frac{1}{(x+3)(x+4)}$ is

A. $\frac{n}{n+2}$

B. $\frac{2n}{n+1}$

C. $\frac{n}{4(n+4)}$

D. $\frac{n}{2(n+2)}$

Ans. C

Sol.

$$\sum_1^n \frac{1}{(x+3)(x+4)}$$

$$= \sum_{x=1}^n \left(\frac{1}{x+3} - \frac{1}{x+4}\right)$$

$$= \frac{1}{4} - \frac{1}{5} + \frac{1}{5} - \frac{1}{6} + \frac{1}{6} - \frac{1}{7} \cdots \frac{1}{n+3} - \frac{1}{n+4}$$

$$= \frac{1}{4} - \frac{1}{n+4}$$

$$= \frac{n}{4(n+4)}$$

30. The surface which intersects the surfaces of the system z(x+y) = c(3z+1) orthogonally and which passes through the circle $x^2 + y^2 = 1$, z = 1, is given by

A. $x^2 + y^2 = 2z^3 + z^2 - 2$

B. $x^2 - y^2 = z^3 + z + 1$

C. $x^2 - y^2 = z^2 + 4$

D. $x^2 + y^2 = z^3 + z^2 + 4$

Ans. A

Sol. Given, system of surfaces

z(x + y) = C (3z + 1)

$$\frac{z(x+y)}{(3z+1)} = C$$

$$Let,\ f(x,y,z) = \frac{z(x+y)}{3z+1} = c$$

The linear partial differential equation corresponding to above curve is,

$$\frac{\partial f}{\partial x} \cdot \frac{\partial z}{\partial x} + \frac{\partial f}{\partial y} \cdot \frac{\partial z}{\partial y} = \frac{\partial f}{\partial z}$$

$$\frac{z}{3z+1} \frac{\partial z}{\partial x} + \frac{z}{3z+1} \frac{\partial z}{\partial y} = \frac{(x+y)}{(3z+1)^2}$$

$$\frac{z(3z+1)}{1} \frac{\partial z}{\partial x} + \frac{z(3z+1)}{1} \frac{\partial z}{\partial y} = x+y$$

The solution is,

$x - y = a$ and $x^2 + y^2 - 2z^3 - z^2 = b$

Any surface which is orthogonal to the above surface is

$x^2 + y^2 - 2z^3 - z^2 = \varphi\ (x - y)$ …(i)

put $x^2 + y^2 = 1$ and $z = 1$ in (1)

(1) $\Rightarrow 1 - 2 - 1 = \varphi\ (x - y) \Rightarrow \varphi\ (x - y) = -2$

(2) $\Rightarrow x^2 + y^2 = 2z^3 + z^2 - 2$

31. In how many years will a sum of ₹ 800 at 10% per annum compounded semi-annually become ₹ 926.10?

   A. $1\frac{1}{3}$ years   B. $1\frac{1}{2}$ years

   C. $2\frac{1}{3}$ years   D. $2\frac{1}{2}$ years

Ans. B

Sol. Given,

   P = Rs. 800

   Amount, A = Rs926.10

   Interest rate, r = 10% semi annual

   $$A_t = P\left(1 + \frac{r/2}{100}\right)^{2t}$$

   $$926.10 = 800\left(1 + \frac{5}{100}\right)^{2t}$$

   $926.10 = 800(1.05)^{2t}$

   $2t \approx 3$

   t = 1.5 years

32. The diagonal of a rectangle is $\sqrt{41}$ cm and its area is 20 sq.cm. The perimeter of the rectangle is

   A. 9 cm   B. 18 cm
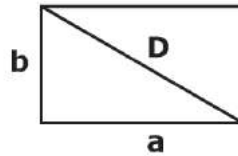
   C. 20 cm   D. 41 cm

Ans. B

Sol. Given,

Let side of rectangle as a & b

Area = ab = 20

Diagonal of rectangle = $D = \sqrt{a^2 + b^2} = \sqrt{41}$

$a^2 + b^2 = 41$

$(a+b)^2 = a^2 + b^2 + 2ab$

$\Rightarrow (a + b^2) = 41 + 2 \times 20 = 81$

a + b = 9

Perimeter = 2(a + b) = 2 × 9 = 18

33. Four persons are chosen at random from a group of 3 men, 2 women and 4 children. The chance that exactly 2 of them are children, is

A. 2/9   B. 4/5

C. 7/12   D. 10/21

Ans. D

Sol. 3 Man   2 Women   4 children

Total = 3 + 2 + 4 = 9

Probability of exactly two the children selected

$$\Rightarrow \quad \frac{3_{c_2} \times 4_{c_2}}{9c_4} + \frac{3_{c_1} \times 2_{c_1} \times 4_{c_2}}{9_{c_4}} + \frac{3_{c_0} \times 2_{c_2} \times 4_{c_2}}{9_{c_4}}$$

$$= \frac{3 \times 6}{126} + \frac{3 \times 2 \times 6}{126} + \frac{1 \times 1 \times 6}{126} = \frac{60}{126} = \frac{10}{21}$$

Alternate

Probability of exactly two the children selected

Two children out of 4 and 2 others from 5

$$\Rightarrow \quad \frac{5_{c_2} \times 4_{c_2}}{9c_4} = \frac{10}{21}$$

34. A man walks 1 km to East and then he turns to South and walks 5 km. Again, he turns to East and walks 2 km. After, he turns to North and walks 9 km. Now, how far he is from his station point?

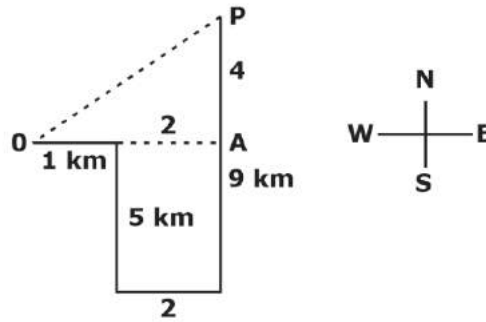A. 3 km   B. 4 km

C. 5 km   D. 7 km

Ans. C

$OP^2 = OA^2 + AP^2$

$\Rightarrow OP^2 = (1+2)^2 + 4^2$

$OP = 5$ km

35. The population of a village is 5500. If the number of males increases by 11 % and the number of females increases by 20 % then the population becomes 6330 . The population of female in the village is

A. 2000   B. 2500

C. 3000   D. 3500

Ans. B

Sol. Initial Population = 5500 = M + F

Next year

Male = 1.11 M

Female = 1.20 F

And total population reaches to = 6330

1.11 M + 1.20F = 6330

M + F = 5500

By solving above two equations,

$\Rightarrow$ M = 3000   F = 2500

36. A, B, C, D and E are five different integers. When written in the ascending order of values, the difference between any two adjacent integers is 4. D is the greatest and A is the least. B is greater than E but less than C. The sum of the integers is equal to E. What is the positive difference between the lowest and the highest integers?

A. 8   B. 6

C. 16   D. 18

Ans. C

Sol.

A   B   C   D   E
⇓   ⇓
Smallest   Largest

B > E

B < C

Thus,

⇒ C > B > E

Correct sequence in ascending order,

A	E	B	C	D
2	x + 4	x + 8	x + 12	x + 16

D − A ⇒ x + 16 − x = 16

37. Mary introduces Jack as the son of the only daughter of my father's wife. How is Jack related to Mary?

A. Brother   B. Son

C. Husband   D. Father

Ans. B

Sol.
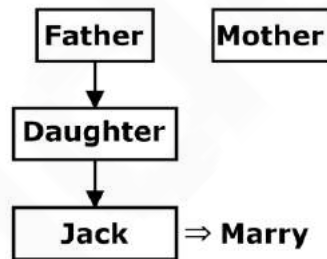
Jack is the son of Marry.

38. The value of $\int_0^1 \int_0^x (x^2 + y^2)dA$, where dA indicates small area in xy-plane, is

A. $\frac{1}{2}$ sq. units   B. $\frac{1}{3}$ sq. units

C. $-\frac{1}{2}$ sq. units   D. $-\frac{1}{3}$ sq. units

Ans. B

Sol.

$$\int_0^1 \int_0^x \left(x^2 + y^2\right) dA$$

$$\int_0^1 \int_0^x \left(x^2 + y^2\right) dy\, dx$$

$$\int_0^1 \left(x^2 y + \frac{y^3}{3}\right)_0^x dx$$

$$\int_0^1 \left(x^2(x-0) + \frac{(x^3-0)}{3} \right) dx$$

$$\int_0^1 \left(x^3 + \frac{x^3}{3} \right) dx = \int_0^1 \frac{4x^3}{3} \, dx$$

$$= \left[\frac{4}{3} \frac{x^4}{4} \right]_0^1 = \frac{1}{3}$$

39. If $x = uv, y = \frac{u+v}{u-v}$, then $\frac{\partial(u,v)}{\partial(x,y)}$ is is

A. $\frac{(u-v)^2}{4uv}$ B. $\frac{(u+v)^2}{4uv}$

C. $\frac{(u-v)}{4uv}$ D. $\frac{(u+v)}{4uv}$

Ans. A

Sol.

$$x = uv \qquad\qquad y = \frac{u+v}{u-v}$$

$$\frac{\partial x}{\partial u} = v \qquad\qquad \frac{\partial y}{\partial u} = \frac{(u-v).1 - (u+v)}{(u-v)^2}$$

$$\frac{\partial x}{\partial v} = u \qquad\qquad \frac{\partial y}{\partial u} = \frac{-2v}{(u-v)^2}$$

$$\frac{\partial y}{\partial v} = \frac{(u-v)1 - (u+v)(-1)}{(u-v)^2}$$

$$= \frac{2u}{(u-v)^2}$$

$$\frac{\partial(x,y)}{\partial(u,v)} = |j| = \begin{vmatrix} x_u & x_v \\ y_u & y_v \end{vmatrix}$$

$$= \begin{vmatrix} v & u \\ \dfrac{-2v}{(u-v)^2} & \dfrac{2u}{(u-v)^2} \end{vmatrix}$$

$$= \frac{2uv}{(u-v)^2} + \frac{2uv}{(u-v)^2}$$

$$= \frac{4uv}{(u-v)^2}$$

$$\frac{\partial(u,v)}{\partial(x,y)} = \frac{1}{|j|} = \frac{(u-v)^2}{4uv}$$

40. If $u = x^3 + y^3$ where

$x = a\cos t, y = b\sin t$, then $\frac{du}{dt} =$

A. $-3a^3\cos^2 t\sin t + 3b^3\sin^2 t\cos t$ B. $3a^3\sin^2 t\cos t + 3b^3\cos^2 t\sin t$

C. $3b\sin^2 t\cos t + 3a^3\sin^2 t\cos t$ D. $-3a^3\sin t + 3b^3\cos^2 t\sin t$

Ans. A

Sol.

$u = x^3 + y^3$

$x = a\cos t, \quad y = b\sin t$

$u \to x, \quad y \to t$

$\dfrac{du}{dt} = \dfrac{\partial u}{\partial x} \cdot \dfrac{dx}{dt} + \dfrac{\partial u}{\partial y} \cdot \dfrac{dy}{dt}$

$\dfrac{du}{dt} = 3x^2 \left(-a\sin t\right) + 3y^2 \left(b\cos t\right)$

$\qquad = 3a^2 \cos^2 t \left(-a\sin t\right) + 3b^2 \sin^2 t \left(b\cos t\right)$

$\dfrac{du}{dt} = -3a^2 \sin t \cos^2 t + 3b^3 \sin^2 t \cos t$

41. Who received the prestigious Abel Prize for the year 2020?

     A. Eric Adelberger and Blayne Heckel

     B. Hillel Furstenberg and Gregory Margulis

     C. Yvonne Farrell and Shelley McNamara

     D. Nina Holden and Lisa Piccirillo

Ans. B

Sol. The Norwegian Academy of Science and Letters has decided to award the **Abel Prize for 2020** to

     1. **Hillel Furstenberg** (Hebrew University of Jerusalem, Israel)

     2. **Gregory Margulis** (Yale University, New Haven, CT, USA)

     "For pioneering the use of methods from probability and dynamics in group theory, number theory and combinatorics."

42. Select the incorrect pair of the 2020 Nobel Prize Winners with their respective areas of contribution:

     (a) Louise Gluck   – Literature

     (b) Andrea Ghez   – Physics

     (c) Jennifer A. Doudna   – Chemistry

     (d) Harvey J. Alter   – Economic Sciences

Ans. D

Sol. The Nobel Prize in Literature 2020 is awarded to **Louise Gluck** "for her unmistakable poetic voice that with austere beauty makes individual existence universal".

The Nobel Prize in **Physics** 2020 is awarded to Reinhard Genzel and **Andrea Ghez** "for the discovery of a supermassive compact object at the centre of our galaxy".

The Nobel Prize in **Chemistry** 2020 is awarded to Emmanuelle Charpentier and **Jennifer A. Doudna** "for the development of a method for genome editing".

The Nobel Prize in **Physiology or Medicine** 2020 is awarded to **Harvey J. Alter**, Michael Houghton and Charles M. Rice "for the discovery of Hepatitis C virus".

43. What is the angle between the hour hand and minute hand of a clock at 3 : 30?

A. 105°   B. 180°

C. 75°   D. 90°

Ans. C

Sol. Angle between Minute hand & hour hand is given by

= |30° × hr − 5.5° × minute| = |30 × 3 − 5.5 × 30| = |90° − 165°| = 75°

44. Sum of the series $2^2 + 4^2 + 6^2 + \cdots \ldots + 20^2$ is

A. 1040   B. 1540

C. 2540   D. 3080

Ans. B

Sol. $2^2 + 4^2 + 6^2 + \ldots 20^2$

4 + 16 + 36 + 64 + 100 + … 400

⇒ 4{1 + 4 + 9 + 16 + 25 + …. + 100)

$4\{1^2 + 2^2 + 3^2 + \ldots + 10^2\}$

As we know that,

$$1^2 + 2^2 + 3^2 + \cdots - \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\Rightarrow \quad 4 \times \frac{10 \times (10+1) \times (20+1)}{6} = \frac{4 \times 10 \times 11 + 21}{6} = 1540$$

45. If A × B means ($A^2 + B^2$), then the value of 5×(4 × 3)

A. 60   B. 300

C. 710   D. 710

Ans. C

Sol. Given,

A X B = $A^2 + B^2$

Then,

5 X 4 X 3 = 5 X ($4^2 + 5^2$)

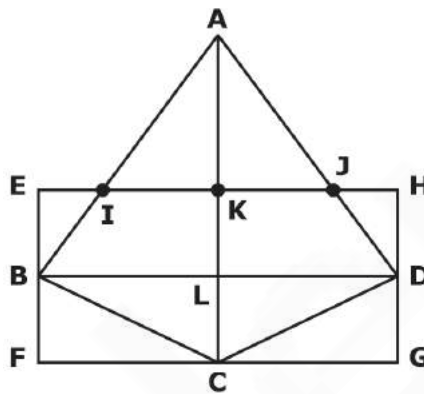5 X 4 X 3 = 5 X 25 = $5^2 + 25^2$

5 X 4 X 3 = 25 + 625 = 650

46. The number of triangles in the given is
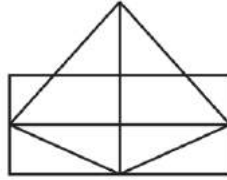
A. 11
B. 13
C. 15
D. 17

Ans. A

Sol. By counting the below figure, there will be 15 triangles

(1) AKI (2) AKJ (3) AIJ (4) ABL (5) ADL (6) ADB (7) EBI (8)JHD (9) CGD (10) BFC (11)) BCL (12) CDL (13 BCD (14) ABC (15) ACD

47. Statement 1: A has more coins than B.

Statement 2: B has fewer coins than C. Statement 3:C has fewer coins than A.

If the statement 1 is true and statement 2 is false, then the statement 3 is

A. True
B. False
C. Uncertain
D. Insufficient data

Ans. A

Sol. Actual statement

I ⇒ A > B (True) ⇒ A>B

II ⇒ B < C False ⇒ B >C

III ⇒ C < A

Thus final sequence,

⇒ A > B > C

⇒ A > C ⇒ 3rd statement true

48. If $\frac{x+1}{x-1} = \frac{a}{b}$ and $\frac{1-y}{1+y} = \frac{b}{a}$, then the value of $\frac{x-y}{1+xy}$ is

A. $\frac{2ab}{a^2-b^2}$
B. $\frac{a^2-b^2}{2ab}$
C. $\frac{a^2+b^2}{2ab}$
D. $\frac{a^2-b^2}{ab}$

Ans. A

Sol. $\dfrac{x+1}{x-1} = \dfrac{a}{b}$

bx + b = ax − a

(ax − bx) = a + b

$x = \dfrac{a+b}{a-b}$

$\dfrac{1-y}{1+y} = \dfrac{b}{a}$

a − ay = b + by

$\Rightarrow (a+b)y = a-b$

$y = \dfrac{a-b}{a+b}$

$\Rightarrow \dfrac{x-y}{1+xy} \Rightarrow \dfrac{\dfrac{a+b}{a-b} - \dfrac{a-b}{a+b}}{1 + \left(\dfrac{a+b}{a-b}\right)\left(\dfrac{a-b}{a+b}\right)}$

$= \dfrac{(a+b)^2 - (a-b)^2}{\left(a^2-b^2\right)+\left(a^2-b^2\right)} = \dfrac{4ab}{2\left(a^2-b^2\right)} = \dfrac{2ab}{a^2-b^2}$

49. If $(2x + 3y):(3x + 5y) = 18:29$, then the value of $x:y$ is

A. $4:1$ B. $4:5$

C. $3:4$ D. $3:1$

Ans. C

Sol. $\dfrac{2x+3y}{3x+5y} = \dfrac{98}{29}$

⇒ 58x + 87y = 54x + 30y

⇒ 4x + 3y

$\dfrac{x}{y} = \dfrac{3}{4}$

50. A is twice as good a workman as B and together, they finish a piece of work in 18 days. In how many days will A alone finish the work?

A. 28 days   B. 30 days

C. 27 days   D. 29 days

Ans. C

Sol. A → days

B = y days = 2x days

if they will work Together, then time taken $\dfrac{xy}{x+y} = 18$

$\dfrac{x \times 2x}{x + 2x} = 18 \Rightarrow x = 27$

51. With a view to encourage and promote Indian artisans and their handicraft, Hunar Haat offers an effective platform. Where was the 22nd Hunar Haat held?

   A. Jaipur   B. Ferozpur
   C. Rampur   D. Bharatpur

Ans. *

Sol. The 22nd "Hunar Haat" is being held from 11th to 22nd November, 2020 at Dilli Haat, Pitampura, Delhi.

52. Which one of the following is not correct pair of Author-Book published in the year 2020?

   A. Arundhati Roy : Azadi

   B. Jairam Ramesh : A Chequered Brilliance

   C. Zadie Smith : Intimations

   D. Diane Cook : One Arranged Murder

Ans. D

Sol. **One Arranged Murder** is the 9th novel and the 12th book overall written by the Indian author **Chetan Bhagat**. The novel is the sequel to Bhagat's 2018 novel The Girl in Room 105.

53. Which one of the following statements is not correct regarding the national education policy 2020 in india?

   A. It proposes sweeping changes in the education system from pre-primary to PhD and skill development

   B. It states that universities from among top 100 in the world will be able to set up campuses in india

   C. It expects that india will achieve 60% GER by 2030

   D. It suggests NAAC to be merged with UGC and AICTE

Ans. C

Sol. National Education Policy (NEP) targets to achieve a gross enrolment ratio **(GER) of 50%** in higher education by 2030 from around 26.3% in FY19.

54. According to the national institutional ranking framework 2020, which institute was on the top in overall ranking?

   A. Indian institute of technology Madras

   B. Indian institute of science, Bangalore

   C. Indian institute of technology, Delhi

   D. Indian institute of technology, Bombay

Ans. A

Sol. **IIT Madras** has been **ranked No. 1** in both 'Overall' and 'Engineering' Categories in National Institute Ranking Framework (NIRF) Ranking 2020.

55. Consider the following statements about ingenuity :

1. It is man's decades-long quest to fly a helicopter on Mars.

2. It is 0-6 meters tall and weight less than 1.8 kg.

3. It aims to look for habitability.

Which of the above statements is / are correct?

A. 3 only   B. 1, 2 and 3

C. 2 only   D. 2 only

Ans. C

Sol. Ingenuity is **intended to demonstrate technologies needed for flying** in the Martian atmosphere.

56. Name the NASA astronaut who after setting the record of 328-day stay in the international space station (ISS), returned through earth's atmosphere and landed on the Kazakhstani desert on 6th feb 2020

A. Josh Cassada   B. Jeanette Epps

C. Christina Koch   D. Peggy Whitson

Ans. C

Sol. **Christina Hammock Koch** served as flight engineer on the International Space Station for Expedition 59, 60 and 61. Koch set a record for the longest single spaceflight by a woman with **a total of 328 days in space**.

57. The thirteenth meeting of the conference of the parties to the convention on the conservation of migratory species of wild animals (CMS COP 13) in 2020 was held in

A. Brazil   B. India

C. Indonesia   D. Canada

Ans. B

Sol. **India hosted the 13th Conference of Parties (COP)** of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) from 17th to 22nd February, 2020 at Gandhinagar in Gujarat. The theme of CMS COP-13 is 'Migratory species connect the planet and we welcome them home'

58. Consider the following statements with respect to the schemes initiated by the government of india in 2020.

1. NISHTHA is a teachers training program

2. SVANidhi is scheme to facilitate artisans to access affordable working capital loan.

3. SATYABHAMA is a scheme to promote research and development in science and technology.

4. Manodarpan is a scheme to promote tourism in rural parts of india.

Which of the above statements is/are correct?

A. 1 and 3 only   B. 2 and 4 only

C. 3 and 4 only   D. 2 only

Ans. A

Sol. • **NISHTHA** is the largest **Teachers' training** programme of its kind in the world. Its Objective is to motivate and equip teachers to encourage and foster critical thinking in students.

• The PM Street Vendor's Atmanirbhar Nidhi (PM **SVANidhi**) scheme, which was launched in June amid the pandemic, is a micro-credit facility that provides **street vendors a collateral-free loan** of Rs 10,000 with low rates of interest for a period of one year.

• **SATYABHAMA** (Science and Technology Yojana for Atmanirbhar Bharat in Mining Advancement) with an aim to promote **research and development in the mining and minerals sector**.

• Union Ministry of HRD has launched **MANODARPAN** initiative to provide **psychosocial support to students** for their Mental Health and Well-being.

59. Which iconic figure set a Guinness World Record in 2020 for receiving 1 million followers for debut on instagram in just 4 hours and 44 minutes?

A. Bong Joon-ho
B. Amy Coney Barrett
C. David Attenborough
D. Sauna Marin

Ans. C

Sol. British television naturalist **David Attenborough** joined Instagram with his debut, Attenborough set a record for fastest to **1 million followers on Instagram in 4 hours 44 minutes**, beating out Jennifer Aniston's debut.

60. Which one of the following statements is NOT correct about the Atal Tunnel ?.

A. It is the highest altitude tunnel in the world

B. It was inaugurated on 03 October 2020 in Rohtang

C. It connects Manali to Lahaul-Spiti valley

D. It is capable of handling 5000 cars and 2500 trucks per day with maximum speed of 80 kmph

Ans. *

Sol. **Mi La Mountain Tunnel** is the world's highest altitude tunnels at an average altitude of 4.752 m (15,590 ft) above the sea level.

61. Match the following:

I	II
A. Act Utilitarian Theory	1. John Locke
B. Rule Utilitarian Theory	2. Immanuel Kant
C. Duty Ethics Theory	3. Richard Brandt
D. The Rights Theory	4. J.S. Mill

Select the correct matching using the code given below:

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

Ans. *

Sol. Act utilitarianism → Jeremy Bentham

Rule utilitarianism → John Stuart Mill

Duty ethics – Immanuel Kant

The right theory – John Locke.

62. Which philosopher suggested Wisdom, Courage, Temperance and Justice as four 'cardinal virtues'?

A. Aristotle   B. Aquinas

C. Socrates   D. Plato

Ans. D

Sol. Plato gave four cardinal virtues

1 → Wisdom → Prudence

2 → Courage → Strength

3. → Temperance → Moderation

4. → Justice → Right & wrong

63. 'Groupthink', a noteworthy feature of the organizational settings within which engineers work and deliberate in groups, has been suggested by

A. Abraham Maslow   B. Irving Janis

C. B. F. Skinner   D. Christopher Meyers

Ans. B

Sol. Irving L. Janis coined the term "Groupthink," and published his research in the 1972 book, "Groupthink." His findings came from research into why a team reaches an excellent decision one time, and a disastrous one the next.

64. Select inappropriate statement about integrity

A. It involves the discovery and communication of the truth

B. It leads to a concern for the whole situation in decision-making, including an awareness of the professional's own attitudes, standards and value systems

C. It is simply truthfulness or avoidance of lying

D. It ensures that the professional does not accept 'moral distance'

Ans. D

Sol. Integrity means "purity of character".

e.g. → If Rs 1 is a bribe for you then Rs 1 crore is also a bribe for you

i.e., your values, altitude & behaviour do not change with situation

Note → Moral distance means a judge in a situation is more likely to have moral decisions based on his/her closeness, awareness about the person on situation.

e.g. – moral distance is like the concept of gravity it changes with respect to distance

65. Whistleblowing in an organizational set up affects :

1. Peer professional relationships

2. Relationships with management

3. Family relations

Which of the above statements is/ are correct ?

A. 1 and 2 only   B. 2 only

C. 1, 2 and 3   D. 1 only

Ans. C

Sol. C

Whistle blowing is to be performed based in four parameters

1 – Need

2 – Proximity

3 – Capability

4 – Last resort

Here, capability relates to the impact of whistle blowing on both personal & professional life of the agent

66. Carol Gilligan is associated with

A. the natural justice   B. the responsibility

C. the principle of loyalty   D. the ethics of care

Ans. D

Sol. D

Carol Gilligan modified Lawrence Kohlberg theory of psychological development .She criticized his theory being male dominated & she gave the concept of morality as "there is different types of morality for males & females"

Male → Justice based morality

Female → Care based morality

67. Hooch & Bootlegging refer to

A. the prohibition law on unethical practices related to liquor

B. laws against giving money to beggars as a generous act

C. food adulteration rules

D. laws on checking the illegal business of duplicate goods

Ans. A

Sol. A is correct as Hooch is another name of illegal liquor

68. The Ministry of Sports and Youth Affairs has recently approved the inclusion of four indigenous games to be part of Khelo India Youth Games 2021. Which one of the following is NOT included ?

A. Thang-Ta   B. Lagori

C. Kalaripayattu   D. Gatka

Ans. B

Sol. The Sports Ministry has approved the inclusion of four indigenous Games to be a part of Khelo India Youth Games 2021, which is scheduled to be held in Haryana.

The four new games are :

• Gatka

• Kalaripayattu

• Thang-Ta

• **Mallakhamba**

The four selected games represent different parts of the country and will get national recognition with the help of the Khelo India Youth Games 2021.

69. Which one of the following is the latest in series being organized as the largest virtual gathering to create dialogues, and accelerate innovation in agriculture?

A. Agri-India Hackathon 2020

B. National Agriculture Higher Education Project

C. ENSURE

D. National Mission for Sustainable Development

Ans. A

Sol. The Agri India Hackathon 2020 is organized by Pusa Krishi, ICAR – Indian Agricultural Research Institute (IARI), Indian Council of Agricultural Research (ICAR) & Department of Agriculture, Cooperation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare.

70. Match the following:

I	II
A. Utkarsh Bangla	1. West Bengal Scheme
B. Placement Linked Skill Training Programme	2. Rajasthan
C. SURYA Scheme	3. Haryana
D. Employment Linked Skill Training Programme	4. Assam

Select the correct matching using the code given below :

  A B C D

A. 2 3 4 1

B. 2 3 1 4

C. 1 4 3 2

D. 1 4 2 3

Ans. C

Sol. • **Utkarsh Bangla scheme** was launched by Hon'ble Chief Minister on 16th February, 2016 for the entire Skill Development interventions to provide wage/self-employment linked skills training to the resident of the **state of West Bengal**.

• **Assam** Skill Development Mission (ASDM) has initiated a State Sponsored **Skill Development Training Program** primarily aiming at training the youth of the state and offering them placements. The program is run on a Public Private Partnership (PPP) Model. Training Partners are empanelled by ASDM after evaluation of their credentials and proposal. Sanction order is issued to the training partners with target of candidates to be trained against the respective trades.

• Under **SURYA** scheme skills It will be provided by engaging training providers empanelled with NSDC or through Sector Skill Councils. (MoU has been signed with NSDC) in **Haryana**.

• **Rajasthan** Skill & Livelihood Development Corporation (RSLDC) aims at developing and implementing skill development programs across Rajasthan through **employment linked skill training program**. The main focus of this program is to empower the youth by providing them dedicated skill training. Providing best in class and laboratory equipment, classroom facilities etc., for the training and making them job-ready. Residential facilities are available with all the safety measures. Currently the following courses are available in our Skill Development Centre.

71. Which one of the following standards is used in vehicular communication system ?

A. IEEE 802.11a
B. IEEE 802.11p
C. IEEE 802.11g
D. IEEE 802.11h

Ans. B

Sol. IEEE 802.11P

IEEE 802.11P is an approved Amendment to the IEEE 802.11 standard to add wireless access. In vehicular environments (wave), a vehicular communication system. IT defines enhancements.

To 802.11 required to support intelligent transportation systems applications.

This includes data exchange between high-speed vehicles and between the vehicles and the road side infrastructure.

72. Which of the following network. metrics are used to evaluate the performance of a network?

A. Throughput and Delay
B. Reliability and Security
C. Topology and Type of connection
D. Portability and Security

Ans. C

Sol. Throughput and delay

When optimizing network performance there are important metrics that must be measured. Some common metrics used to measure network traffic performance include latency packet loss indicators, jitter, band width and throughput.

73. Which of the following things are defined by uniform resource locator for specifying the information on the internet?

   A. protocol, host computer, throughput and delay

   B. host computer, destination computer and delay

   C. throughput, delay, port and path

   D. protocol, host computer, port and path

Ans. D

Sol. URL protocols includes HTTP and HTTPS for web resources, mail to for email addresses. Optionally, after the domain a URL can also specify.

   – A path to a specific page or file withing a domain.

   – A network port to use to make the connection.

   – A specific reference point within a file such as a named anchor in an HTML file.

74. Which one of the following documents are created and handled by the Common Gateway Interface (CGI) technology?

   A. Dynamic documents   B. Static documents

   C. Tampered documents   D. Linked documents

Ans. A

Sol. Dynamic documents

CGI stands for common gateway interface. It is technology that enables a web browser to submit forms and connect to programs over a web server. It is best way for a web server to send forms and connect to programs on the server. It is an interface for running executable via a web server. It means taking an HTTP request and passing it to an application in order to deliver a dynamically generated HTML page back to a browser.

75. Which one of the following learnings uses web technology to conduct conventional classes with distant learners?

   A. Learner-led e-learning

   B. Instructor-led e-learning

   C. Telementoring and e-coaching

   D. Facilitated e-learning

Ans. D

Sol. e-campus is a web-based application designed for creating web-based learning contents different kinds of courses and for supporting web based and blended learning.

An e-learning environment for distance learning, where two different course facilitation techniques were applied for two different groups of students is presented in the paper.

76. Which one of the following frame- works is developed to assess the value of the increasing investments made on e-governance projects in terms of service orientation, technology architecture, replicability and sustainability in various states across the country?

   A. Technology Group@IMRB

   B. e-Governance Assessment Framework

   C. Sustainable Access in Rural India

   D. e-Governance Action Plan

Ans. D

Sol. The National e-governance Plan(NeGP) takes a holistic view of e-governance initiative across the Country, integrating them into a collection Vision.

The ultimate objective is to bring public services closer to the citizens. Makes all the government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable cost. Option D is Correct.

77. Which one of the following services does NOT come under category of Cloud computing ?

   A. IaaS (Infrastructure as a Service)

   B. SaaS (Software as a Service)

   C. PaaS (Platform as a Service)

   D. BDaaS (Big data as a Service)

Ans. D

Sol. Cloud computing service types.

   Option A: Iass (infrastructural as a service) provides user access to raw computing resources such processing data storage, power, and networking.

   Option B: Sass (Software as a service) provides offer application-level services.

   Option C: Pass (Platform as a service) provides a runtime environment. It allows programmers to easily grate, test, run and deploy we applications.

   Option D: BDaas (Big data as a service) option D is not come under category of cloud computing.

78. What is the key size of Data Encryption Standard algorithm in cryptography?

   A. 56 bit   B. 62 bit

   C. 168 bit   D. 128 bit

Ans. A

Sol. DES (Data Encryptions Standard) uses a 56-bit key. Actually, the initial key consists of 64 bits, however, before DES process starts, energy 8th bit of the key is discarded to produce a 56-bit key.

Option A: 56-bit correct.

79. Which one of the following statements is NOT correct about the codes of conduct?

A. These cover general guiding principles

B. Their purpose is to regulate the conduct of members on various transactions

C. These are the broader sets of principles that are designed to inform specific laws or government actions

D. These translate the values into specific behavioral standards, keeping in mind the possible reflection on the stakeholders' interest

Ans. D

Sol. Option (D) actually relates to "code of ethics" not "code of conduct"

Code of conduct	Code of ethics
1. Focus on manners & etiquettes	1. Focus on decision making
2. Focus on smaller decisions	2. Focus on big decisions
3. Based on rules conventions & Customs	3. Based on values, morals & ethics.

80. The famous statement "The weak, can never forgive. Forgiveness is the attribute of the strong" is given by

A. Swami Vivekananda

B. Mahatma Gandhi

C. Martin Luther

D. Sri Aurobindo

Ans. B

Sol. Mahatma Gandhi said, "The weak can never forgive; forgiveness is the attribute of the strong", he meant is with his heart and soul but we talk of forgiveness only in vague terms. We don't really want to forget, forgive and move on.

81. Phillip Kotler argues that the 4 Ps which represent the seller's thinking more than buyer's thinking can be translated into the 4 C. Match the following :

4 Ps of Marketing Planning	4 Cs of Marketing Planning
A. Product	1. Customer communication
B. Price	2. Customer value
C. Place	3. Customer costs
D. Promotion	4. Customer convenience

Select the correct matching using the code given below :

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

Ans. A

Sol.

4 P's of Market Planning	4 C's of Market Planning
Product	Customer value
Price	Customer Cost
Place	Customer convenience
Promotion	Customer Communication

7 C's compass model

A. **Corporation-** The core of *4 Cs* is a corporation (company and non-profit organization). The company have to be accountable and compliant.

B. **Commodity**: The product or service offered by the company.

C. **Cost**: Total cost of production, including materials, human resources, machinery to create the product or service.

D. **Communication**: This covers advertising, sales promotions.

E. **Channel**: This domain deals with product or service distribution to the consumer.

F. **Consumer**: This domain deals with the needs and wants of the consumer. It also covers consumer education, warranty aspect.

G. **Circumstances**: External factors like National policy, social and cultural norms, weather and economy are outside of Company. Companies have to adjust themselves as to condition demands.

82. The Boston Consulting Group matrix classifies business in four categories: as "STAR", "QUESTION MARK", "CASH COWS". Which one of the following is the fourth one?

A. CATS

B. HORSES

C. DOGS

D. HENS

Ans. C

Sol. The **Boston Consulting Group** (BCG) growth-share matrix breaks down products into four categories, known heuristically as "**dogs**," "cash cows," "stars," and "question marks." Each category quadrant has its own set of unique characteristics.

83. Under which one of the following circumstances is the project accepted as worthwhile, keeping the principal non-discounting criteria ?

A. The payback period (PBP)> target period

B. The payback period (PBP)< target period

C. The payback period (PBP)= target period

D. The payback period (PBP)=0

Ans. B

Sol.

- The payback period refers to the amount of time it takes to recover the cost of an investment.
- A targeted period means the maximum acceptable payback period.
- In the principle of non-discount, the time value of the currency is not considered. So, money earned in future has the same value as money invested in the past.
- Project worthwhile means profitability.
  - ➢ if payback period < Targeted period then Accept
  - ➢ if payback period > Targeted period then *Reject*

84. The purpose of oil in a transformer is to

A. protect the transformer from rusting

B. avoid wear and tear of the transformer

C. transfer heat from winding and core to the cooling surfaces of the transformer

D. avoid noise in a transformer

Ans. C

Sol. The transformer windings dissipate heat that needs to be removed in order to protect transformer from thermal damage. Transformer oil absorbs this heat from the windings & core and dissipate it to the outside atmosphere.

85. For a semiconductor to be called as p-type semiconductor, which one of the following element impurities are added to a pure semiconductor?

A. Phosphorus

B. Arsenic

C. Antimony

D. Boron

Ans. D

Sol.   To make p type semiconductor trivalent impurity are added

Ex: B,   Al,   Ga,   In

↓   ↓   ↓   ↓

Boron   Aluminium   Gallium   Indium

86. Impure semiconductor

     A. has more conductivity in contrast to pure semiconductor

     B. has less conductivity in contrast to pure semiconductor

     C. has electrons and holes in equal number

     D. has a fermi level which is in the centre of conduction and valence bands

Ans. A

Sol. Impure semiconductor or doped semiconductor has more conductivity because doping process increases the conductivity of semiconductor. Due to doping charge carriers increases so conductivity increases.

     Pure semiconductor does not have sufficient carries as compared to doped semiconductors. That's why pure semiconductors have less conductivity.

87. Which one of the following is the disadvantage of ion-implantation over diffusion doping ?

     A. It is a low temperature process

     B. Point imperfections are not produced

     C. Shallow doping is possible

     D. Gettering is possible

88. Which one of the following is correct in n -p-n transistor ?

     A. Collector and emitter terminals can be exchanged

     B. Collector is heavily doped, base width is small and emitter area is large

     C. Emitter, base and collector regions are cqually doped

     D. Emitter is heavily doped, base width is small and collector area is large

Ans. D

Sol. In transistor, Emitter is made heavily doped in order to inject charge carriers into the base. Base width is small and it is very lightly doped so that injected charge does not recombine at base. Collector is moderately doped that collects charge carriers coming from base side.

89. Which one of the following factors does NOT characterize the formation of non-crystalline structure ?

     A. Presence of primary bonds in the directions

     B. Non-formation of three-dimensional primary bond

     C. Weak secondary bond

     D. Open network of the atomic packing

Ans. A

Sol. Non-crystalline structure lacks symmetric and regular arrangement of atoms over large atomic distances. They are also known as amorphous or supercooled liquids which does not have the primary bonds in their structures.

90. Which one of the following protocols is used to address the true routing decisions problems?

    A. Exterior Gateway Protocol

    B. Border Gateway Protocol

    C. Open Shortest Path First Protocol

    D. Interior Gateway Routing Protocol

Ans. C

Sol. OSPF (Open Shortest Path First) protocol is one of a family of IP routing protocols and is an interior.

Gateway protocol (IGP for the internet used to distribute IP routing in formation throughout a single autonomous system (AS) in an IP network.

The OSPF protocol is a link state routing protocol, which means that the router exchange topology information with their nearest neighbors.

The main advantage of a link state routing protocol like OSPF is that complete knowledge of topology allows routers to calculate routes.

91. Match the following :

I	II
A. Thompson	1. The concept of converting mechanical work in heat
B. James P. Joule	2. The theory of relativity
C. Max Planck	3.The energy characteristics of light
D. Albert Einstein	4. The energy equivalence between heat, work and electric power

Select the correct matching using the code given below:

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

Ans. B

Sol.

A. Thompson had given the concept of converting the mechanical work into the heat.

B. James P. Joule experimented with engines, electricity and heat in his life & found the energy equivalence between heat, work and electric power.

C. Max Planck given the energy characteristics of light i.e. E = hv in 1900 & introduced the Planck's constant 'h'. This work laid the foundation for quantum theory.

D. Albert Einstein introduced the General theory of relativity to the world in 1915, it helped in understanding of gravity effect on fabric of space-time.

A → 1, B → 4, C → 3, D → 2.

92. According to UNEP, which of the following is/are the major component/s of air pollution ?

    1. SO_2 2. O_3

    3. CO   4. NO_2

    Select the correct answer using the code given below :

    A. 2 and 3 only

    B. 2 only

    C. 2,3 and 4 only

    D. 1,2,3 and 4

Ans. D

Sol. According to UNEP, the air pollutants which are major sources of air pollution are

    (1) CO

    (2) CO_2

    (3) NO_2

    (4) Ground Level Ozone

    (5) Particulate Matter

    (6) SO_2

    (7) Hydrocarbons & Lead

93. Which one of the following is a 'soft _coal'?

    A. anthracite

    B. bituminous

    C. lignite

    D. magnetite

Ans. B

Sol. Bituminous coal, called soft coal has slightly lower carbon content than anthracite. It is used for electricity & steel production. It has shiny & layered texture.

94. Which one of the following is NOT correctly matched pair regarding the regional biodiversity?

    A. Point :   The number of species richness that can be found at a single point in a given space

    B. Alpha :   The number of species richness found in a small heterogeneous area

    C. Beta :   The rate of change in richness species composition across different habitats

    D. Gamma :   94 The rate of change richness across large landscape gradients

Ans. B

Sol. **Point Richness:** The number of species that can be found at a single point in a given space. **Alpha Richness:** Alpha richness refers to diversity within a particular area or ecosystem.

Beta diversity or Richness: The rate of change in species composition across different habitats.

Gamma Richness: The rate of change across large landscape gradients.

95. Energy services for sustainable development are directly linked to

1. Poverty
2. Lifestyles
3. Women
4. Deforestation

Select the correct answer using the code given below :

A. 1,2 and 3 only

B 1,2 and 4 only

C. 2,3 and 4 only

D. 1 and 3 only

Ans. A

Sol. Energy services for sustainable development are linked to improvement of <u>Poverty</u> such as lack of education, inadequate health care and hardship on <u>women</u> & children.

At local & national level, a reliable energy supply is essential for economic stability and growth, jobs & improved <u>living standards</u>.

96. Match the following:

I	II
A. Oligotrophic lakes	1. created due to construction of dams
B. Dystrophic lakes	2. low pH and high humic lakes acid content
C. Meromictic lakes	3. low nutrient concentration
D. Impoundments	4. rich in salts and permanently stratified

Select the correct matching using the code given below :

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

Ans. D

Sol. (A) Oligotrophic lakes – These lakes rave low nutrient concentration.

(B) Dystrophic lakes – These lakes, also known as humic lakes, are the lakes that contain high amounts of humic substances and organic acids.

(C) Meromictic lakes – These lakes are rich in salts and permanently stratified. In these lakes, the bottom water usually contains dissolved salt.

(D) Impoundments – These are created due to construction of dams.

A – 3

B – 2

C – 4

D – 1

97. Which one of the following is NOT included in the 27 principles issued at the Rio-92 UN Conference on the Environment and Development?

A. The right to development that meets the needs of present and future generations

B. Right to safety from natural disasters

C. Protection to the environment in times of armed conflict

D. Youth mobilization for a global partnership

Ans. B

Sol. Option (A) is directly taken from Principle 3.

Principle 3: The right to development must be fulfilled so as to equitable meet developmental and environmental needs of present and future generations.

Option (B) is not directly taken from Principle 18, as it is mentioned that state shall notify other states in case of natural disaster, but there is no mention of Right to Safety.

Principle 18: States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted. Option (C) is directly taken from Principle 24.

Principle 24: Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed Conflict and cooperate in its further development, as necessary.

Option (D) is directly taken from Principle 21.

Principle 21: The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership In order to achieve sustainable development and ensure a better future for all.

98. What are the objectives and functions of state financial corporations?

1. The main function is to provide non-term loans for the acquisition of land, building, plant, machinery and other movable assets.

2. To finance expansion, modernization and upgradation of technology in the existing units.

3. To assist for the promotion of industry by the rural and urban artisans.

4. Providing seed capital assistance under the scheme of Industrial Development Bank of India.

Select the correct answer using the code given below :

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

Ans. C

Sol. State Finance Corporations does not assist the promotion of industry by the rural and urban artisans.

99. From the following, which facilities are provided for units in the export processing zone?

1. Developed plots/ready-buildings to suit project requirements.

2. Second hand capital goods allowed to be exported.

3. Foreign equity participation up to 100% permissible.

4. Assured power supply, preferential power connection.

Select the correct answer using the code given below :

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

Ans. B

Sol. India export processing zone Overview of objectives :-

- To encourage establishment and development of Indian industries and business enterprises and facilitate with proper infrastructure.
- 100% foreign direct investment (FDI) are allowed for all the manufacturing activities
- Export of finished goods.

100. Which one of the following is NOT the purpose of the organization breakdown structure ?

A. To provide a framework to summarize organization unit work performance

B. Do not tie the organizational unit to cost control accounts

C. Identify organization units responsible for work packages

D. How the firm has organized to discharge work responsibility

Ans. B

Sol. **Purpose of Organizational Breakdown Structure**

It is used to define the responsibilities for

1. Project management

2. Cost reporting,

3. Billing

4. Budgeting

5. Project control

   ➤ All dimensions mentioned above are applied to each unit.

Since Cost is a direct factor in Organizational Breakdown Structure Hence, it must be included.

****

ESE 2021 Prelims - General Studies & Engineering Aptitude (Paper-1)
Answer Key (All Sets)

Set A

1	B	26	D	51	B	76	C
2	D	27	D	52	D	77	C
3	B	28	A	53	C	78	D
4	B	29	D	54	B	79	C
5	A	30	B	55	C	80	A
6	D	31	*	56	*	81	D
7	B	32	D	57	A	82	C
8	C	33	B	58	A	83	C
9	*	34	D	59	C	84	B
10	*	35	C	60	C	85	B
11	A	36	D	61	B	86	C
12	C	37	A	62	B	87	D
13	B	38	B	63	D	88	B
14	C	39	A	64	C	89	C
15	D	40	C	65	B	90	C
16	A	41	*	66	C	91	D
17	*	42	D	67	B	92	C
18	D	43	C	68	B	93	D
19	A	44	A	69	A	94	D
20	C	45	C	70	A	95	B
21	B	46	C	71	C	96	A
22	C	47	B	72	C	97	B
23	D	48	A	73	B	98	B
24	A	49	C	74	A	99	D
25	D	50	*	75	B	100	A

Set B

1	*	26	A	51	D	76	C
2	D	27	*	52	C	77	B
3	C	28	D	53	D	78	B
4	A	29	A	54	D	79	A
5	C	30	C	55	B	80	A
6	C	31	B	56	A	81	B
7	B	32	D	57	B	82	D
8	A	33	B	58	B	83	C
9	C	34	B	59	D	84	B
10	*	35	A	60	A	85	C
11	*	36	D	61	D	86	*
12	D	37	B	62	C	87	A
13	B	38	C	63	C	88	A
14	D	39	*	64	B	89	C
15	C	40	*	65	B	90	C
16	D	41	B	66	C	91	C
17	A	42	C	67	D	92	C
18	B	43	D	68	B	93	B
19	A	44	A	69	C	94	A
20	C	45	D	70	C	95	B
21	A	46	D	71	B	96	C
22	C	47	D	72	B	97	C
23	B	48	A	73	D	98	D
24	C	49	D	74	C	99	C
25	D	50	B	75	B	100	A

Set C

1	D	26	C	51	*	76	D
2	C	27	C	52	D	77	D
3	D	28	D	53	C	78	A
4	D	29	C	54	A	79	D
5	B	30	A	55	C	80	B
6	A	31	B	56	C	81	A
7	B	32	B	57	B	82	C
8	B	33	D	58	A	83	B
9	D	34	C	59	C	84	C
10	A	35	B	60	*	85	D
11	D	36	C	61	*	86	A
12	C	37	B	62	D	87	*
13	C	38	B	63	B	88	D
14	B	39	A	64	D	89	A
15	B	40	A	65	C	90	C
16	C	41	B	66	D	91	B
17	D	42	D	67	A	92	D
18	B	43	C	68	B	93	B
19	C	44	B	69	A	94	B
20	C	45	C	70	C	95	A
21	C	46	*	71	B	96	D
22	C	47	A	72	C	97	B
23	B	48	A	73	D	98	C
24	A	49	C	74	A	99	*
25	B	50	C	75	D	100	*

Set D

1	C	26	C	51	B	76	A
2	C	27	D	52	D	77	*
3	B	28	B	53	B	78	D
4	A	29	C	54	B	79	A
5	B	30	C	55	A	80	C
6	C	31	B	56	D	81	*
7	C	32	D	57	B	82	D
8	D	33	C	58	C	83	C
9	C	34	B	59	*	84	A
10	A	35	C	60	*	85	C
11	B	36	*	61	B	86	C
12	B	37	A	62	C	87	B
13	D	38	A	63	D	88	A
14	C	39	C	64	A	89	C
15	B	40	C	65	D	90	*
16	C	41	D	66	D	91	*
17	B	42	C	67	D	92	D
18	B	43	D	68	A	93	B
19	A	44	D	69	D	94	D
20	A	45	B	70	B	95	C
21	D	46	A	71	A	96	D
22	C	47	B	72	C	97	A
23	C	48	B	73	B	98	B
24	B	49	D	74	C	99	A
25	B	50	A	75	D	100	C

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