ESE (P), 2023

GENERAL STUDIES Paper-A

1. Which one of the following scientists called entropy time arrow?
(a) Thomas Young
(b) Arthur Eddington
(c) Max Planck
(d) Thompson

2. Consider the following statements:
Energy balances are fundamental for energy planning, since they allow analysing aspects such as:
1. distribution of final energy con- Sumption per end-use sector.
2. storage and refinement of each fuel or group of energies in the matrix.
3. self-sufficiency in energy, foreign dependence and foreign trade.
4. efficiency in processes for trans- forming primary energy into secondary

Which of the above statements is/are NOT correct?
(a) 2 only (b) 1 and 2 only
(c) 1, 2 and 3 only (d) 4 only

3. Which one of the following is NOT an advantage of energy efficiency?
(a) The cost of energy economy is usually smaller than that of its generation
(b) Security of supply increases and resources which are finite are saved
(c) There are micro and macro- economic gains associated with an increase in productivity and in industrial competitivity
(d) The access to energy services is decreased

4. The British economist Nicholas Stern gave the most impressive analysis in the year 2006 on
(a) Ozone layer depletion
(b) Renewable energy sources
(c) Climate change
(d) Deforestation

5. Consider the following factors determining the evolution of energy intensity:
1. dematerialization
2. fuel use intensity
3. recycling

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

6. Surface rocks on Earth are cool, but below the surface the temperature increases with depth. This is called
(a) the geothermal gradient
(b) the homogeneous accretion
(c) the pangaea
(d) the mesocrates

7. Which one of the following is NOT correct?
(a) The formation of a mountain chain by the compression of crustal rocks is known as an orogeny
(b) Rock between the two extremes is called mesocratic
(c) Sediments are deposited in hori- zontal layers called clay plates
(d) Particles deposited as sediments are changed into rock by the pressure of later deposits at low temperature is called diagenesis

8. Consider the following statements for hammock activities:
1. It derives its name because it spans over a segment of a project.
2. The hammock activity duration is determined after the network plan is not drawn.
3. The hammock activities are frequently used to identify the use of fixed resources or costs over a segment of the project.
4. The maximum amount of time an independent activity must be delayed to

begin or end.

Which of the above statements are correct?

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

9. Consider the following strategies for mitigating risk under risk response development:

1. Reduce the likelihood that the event will occur
2. Reduce the impact that the adverse event would have on the project
3. Analyze the project to identify sources of risk
4. Assess risks in terms of severity of impact

Which of the above strategies are correct?

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

10. Consider the following statements:

The strategy is to assign extra time at critical moments in the project, buffers are added to:

1. activities with no risk.
2. merge activities that are prone to delays due to one or more preceding activities being late.
3. non-critical activities to reduce the likelihood that they will create another critical path.
4. activities that require scarce resources resources needed. to ensure that the are available when

Which of the above statements are correct?

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

11. Which one of the following does NOT always yield an optimal schedule, however it is capable of yielding a "good" schedule for very complex networks having many types of resources?

(a) Algorithm (b) Optimum
(c) Backhoes (d) Heuristics

12. According to CCPM, using 50/50 estimates will discourage Parkinson's law, the student syndrome, and self- protection from coming into play because there is less "free time" available. What does the abbreviation CCPM stand for?

(a) Control Chain Project Management
(b) Creating Chain Project Management
(c) Computer Control Project Management
(d) Critical Chain Project Management

13. According to project cost-duration graph, any reduction in project duration means a reduction in

(a) direct costs
(b) indirect costs
(c) total costs
(d) optimum costs

14. When a pair of one cation and one anion are absent from an ionic crystal, then the defect is called

(a) Schottky's defect
(b) Frenkel's defect
(c) Cross-slip defect
(d) Stacking defect

15. The diffusion coefficient for copper in aluminium at 500°C and 600°C are 4.8×10^{-14} m^2/s and 5.3×10^{-3} m^2/s respectively. What is the approximate time at 500°C that will produce the same diffusion result (in terms of concentration of copper at some specific point in aluminium) as 10 h heat treatment at 600°C?

(a) 110.4 h
(b) 152.4 h
(c) 210.4 h
(d) 252.4 h

16. A relatively large plate of a glass is subjected to a tensile stress of 40 MPa. If the specific surface energy and modulus of elasticity for this glass are 0.3 J/m^2 and 69 GPa, respectively, what is approximate maximum length of a surface flaw that is possible without fracture?

(a) 6.2 μm (b) 8.2 μm
(c) 10.2 μm (d) 12.2 μm

17. A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, what is the resultant elongation approximately?
(a) 3.3 mm (b) 0.33 mm
(c) 0.77 mm (d) 7.7 mm

18. What is the approximate value of ductility (%EL) of a cylindrical copper rod if it is cold worked such that the diameter is reduced from 15.2 mm to 12.2 mm? (Take the tensile strength from the curve for copper as 340 MPa)
(a) 7%
(b) 3.56%
(c) 70%
(d) 35.6%

19. The density of α-Fe is 7.87×10^3 kg/m³. Atomic weight of Fe is 55.8. If α-Fe crystallises in BCC space lattice, what is the lattice constant approximately? (Take Avogadro's number (N) = 6.02×10^{26}/kg/mole and number of atoms per unit cell is 2)
(a) 0.666 Å
(b) 1.766 Å
(c) 2.866 A
(d) 3.966 Å

20. Which one of the following statements is related to frequency hopping spread spectrum?
(a) It is a spread spectrum technique which allows for the coexistence of multiple networks in the same area by separating different networks using different hopping sequences
(b) It is a spread spectrum technique which allows for the coexistence of multiple networks in the different area by separating different networks using different hopping sequences
(c) It is a spread spectrum technique which does not allow for the coexistence of multiple networks in the same area by separating same networks using different hopping sequences
(d) It is a spread spectrum technique which allows for the coexistence of single network in the different area by separating different networks using same hopping sequence

21. Which one of the statements is NOT relevant to quantum computing?
(a) Quantum computing is that much more powerful functions may be computed using qubits and quantum gates
(b) Quantum operations are well adapted to describe discrete state changes, that is, transformations between an initial state and final state, without explicit reference to the passage of time
(c) Quantum computation does not support. entanglement and measurements of a quantum computer's registers can yield only a small, discrete set of values
(d) Quantum computing is the use of quantum phenomena such as superposition and entanglement to perform the computation

22. A device which exhibits irregular or unpredictable response times is called
(a) Asynchronous
(b) Synchronous
(c) Sharable
(d) Non-sharable

23. Which one of the following tables is used by operating system to keep the track of many I/O requests at the same time?
(a) File allocation table
(b) Device status table
(c) Memory status table
(d) Interrupt driven table

24. A stream of a video image that is one-quarter the size of a standard TV image; that is, it has a resolution of 352 by 240 pixels. If each pixel is represented by 24 bits of information, as would be the case for 24-bit color, then what is the approximate size of each frame?
(a) 247.5 KB (b) 352.5 KB
(c) 417.5 KB (d) 532.5 KB

25. What is the approximate effective throughput, if user wants to fetch a 1-MB file across a 1-Gbps network with a round-trip time of 100 ms?
(a) 50.1 Mbps
(b) 74.1 Mbps

(c) 84.1 Mbps
(d) 90.1 Mbps

26. In a network, a transcontinental channel with a one-way latency of 50 ms and a bandwidth of 45 Mbps is able to hold how many bits that fit in the pipe approximately?
(a) 2.25×10^6 bits
(b) 1.25×10^6 bits
(c) 50.00×10^6 bits
(d) 45.00×10^6 bits

27. Consider the following statements for significance of prominence in the Internet architecture
1. Programmers are free to define new channel abstractions or applications that run on top of any of the existing protocols.
2. It defines a common method for exchanging packets among a wide collection of networks.
3. It allows someone to propose a new protocol to be included in the architecture.

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

28. Consider the following statements regarding the failure in the network:
1. Bit errors typically occur because outside forces, such as lightning strikes, power surges, and microwave ovens, interfere with the transmission of data.
2. One of the main difficulties in dealing with lost packets is distinguishing between a packet that is indeed lost and one that is merely late in arriving at the destination.
3. The failure can be caused by software that crashes, a power failure, or a reckless backhoe operator.

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

29. Which one of the following statements is NOT correct regarding human values?
(a) Values mean an in-built mechanism which distinguishes the right from the wrong
(b) Values provide us with a unique, personal, and moral template that we use subconsciously to assess and judge the intensions and actions of others and ourselves
(c) Values serve the process of 'becoming' in the sense of transformation of the level of consciousness to purer, higher levels
(d) Values are essentially objective while skills are subjective

30. Consider the following objectives of the study on professional ethics :
1. Forming consistent viewpoints based on facts
2. Searching beyond obvious the alternative responses to issues and being receptive to creative solutions
3. Comprehending, assessing dif- ferent views

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

31. Which one of the following statements is NOT correct?
(a) Notions or beliefs about manners, tastes, customs, and towards laws are few examples of morality
(b) Morality is more general and prescriptive based on customs and traditions; whereas ethics is specific and descriptive
(c) Morality thrusts on judgment and punishment, in the name of God or by laws; whereas ethics, thrust is on influence, education, training through codes, guidelines, and correction
(d) Morality is more concerned with the results of wrong action, when done; whereas ethics is with the results of a

right action, when not done

32. The 'work ethics' is aimed at NOT ensuring which of the following?
(a) The economy and productivity
(b) Safety and privacy
(c) Consumption and distribution
(d) Health and hygiene

33. Which one of the following is NOT included under the categories of civic virtues as indispensable for a self- governing administration?
(a) Self-reflection (b) Self-restraint
(c) Self-reliance (d) Self-assertion

34. Spirituality is promoted in the work- place by adhering to the following activities:
1. Verbally respect the individuals as humans and recognize their values in all decisions and actions.
2. Support causes business outside the business
3. Do unto others as you would have them do unto you.
4. Realization of the self-potential through meditative acts.

Which of the above activities are correct?
(a) 2, 3 and 4 only (b) 1, 2, 3 and 4
(c) 2 and 3 only (d) 1, 2 and 3 only

35. The normative sense of engineering ethics does NOT include:
(a) Knowing moral values, finding accurate solutions to moral problems and justifying moral Judgments in engineering practices
(b) Generating alternate courses of action to resolve the dilemma
(c) Study of decisions, policies, and values that are morally desirable in the engineering practice and research
(d) Using codes of ethics and standards and applying them in their transactions by engineers

36. Which one of the following characteristic features distinguishes Carol Gilligan's theory from Kohlberg's theory with regard to the moral development?
(a) Transactional approach
(b) Logic and rule centric
(c) More of caring
(d) Justice

37. Which one of the following theorists and philosophers is NOT associated with the 'Duty Ethics'?
(a) Immanuel Kant (b) John Locke
(c) John Rawl (d) C. W. D. Ross

38. Consider the following non-reliability performance measures of automobile industry related objects:
1. Fuel efficiency (km/1)
2. Economic efficiency (cost/km/kg)
3. Quality of ride
4. Emissions (ppm)

Which of the above performance measures are correct?
(a) 1, 3 and 4 only (b) 1, 2 and 3 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

39. Match the following:

List I (Severity of failure)		List II (Impact of failure	
P.	Catastrophic	1.	Less than minor injury or system damage
Q.	Critical	2.	Minor injury or minor system damage
R.	Marginal	3.	Result in death or total system loss
S.	Negligible	4.	Result in severe injury or major system damage

Select the correct pair using the code given below:
(a) P-3, Q-4, R-2, S-1
(b) P-4, Q-3, R-1, S-2
(c) P-2, Q-1, R-3, S-4
(d) P-1, Q-2, R-4, S-3

40. Consider the following statements for the multi-state characterization (infinite number of states) with $K = \infty$.
1. X(t) is non-decreasing.
2. X(t) is continuous-time stochastic process.
3. Higher value of X(t) implies greater degradation and the item failure time.

Which of the above statements are correct?

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

41. Six sigma gives a precision of
(a) 99.9997% (b) 98.4599%
(c) 97.7333% (d) 96.2799%

42. Consider the following statements with reference to six-sigma:
1. It is a methodology for structured, process oriented and systematic quality improvement.
2. It provides a systematic approach for quality and process in improvement, rather than being just a collection of tools.
3. It is a rigorous, data-driven, decision-making approach to analyse the root of problems

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

43. As sigma level increases,
(a) cost of poor quality and customer satisfaction both go up
(b) cost of poor quality goes up and customer satisfaction goes down
(c) cost of poor quality goes down and customer satisfaction goes up
(d) cost of poor quality and customer satisfaction both go down

44. Consider the following statements regarding the design for six-sigma:
1. The concept of six-sigma origi- nated at Motorola.
2. The goal is to arrive at 3-4 defects per million opportunities.
3. Sigma is used to compare expected outcomes versus failures in a population

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

45. In a plain scale, if 1.5 inches = 1 foot and it can measure upto 4 feet, what is the representative factor of the scale ?
(a) $\frac{1}{8}$ (b) $\frac{1}{4}$
(c) $\frac{1}{1.5}$ (d) $\frac{2}{1.5}$

46. Which one of the following is used when components of same shape but different dimensions are to be manufactured?
(a) Drawing for installation
(b) Tabular drawing
(c) Schematic assembly drawing
(d) Patent drawing

47. Which one of the following lines is used to represent the outlines of adjacent parts or alternative and extreme positions of movable parts?
(a) Continuous thick line
(b) Continuous thin line
(c) Chain thin double-dashed line
(d) Dashed thin line-

48. If a line is inclined to the H.P. and parallel to the V.P., then it has
(a) no trace
(b) only V.T. but no H.T.
(c) both H.T. and V.T.
(d) only H.T. but no V.T

49. A triangular prism, base 40 mm side and axis 50 mm long is resting on one of its bases on the H.P. with a vertical face perpendicular to the V.P. What is the front view of the prism?
(a) a triangle
(b) a rectangle
(c) combination of two rectangles
(d) combination of triangle and rectangle

50. Consider the following points while drawing the isometric view of any solid :
1. The isometric view should be drawn according to the given views and in such a way that maximum possible details are visible.
2. At every point for the corner of a solid, at least three lines for the edges must converge. Of these, at least two must be for visible edges.
3. Two lines (for visible edges) will never cross each other.

Which of the above statements are correct?
(a) 1 and 2 only
(b) 2 and 3 only

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

51. Which one of the following methods is used when the non-isometric lines or their ends lie in isometric planes?

(a) Co-ordinate method
(b) Box method
(c) Offset method
(d) Visual-ray method

52. If $X_1 = \begin{bmatrix}1\\1\\1\end{bmatrix}, X_2 = \begin{bmatrix}1\\0\\1\end{bmatrix}$, and $X_3 = \begin{bmatrix}0\\1\\1\end{bmatrix}$ are the eigenvectors of the matrix

$A = \begin{bmatrix}2 & 1 & -1\\3 & 2 & -3\\3 & 1 & -2\end{bmatrix}$, then $A^5 =$

(a) $\begin{bmatrix}32 & 31 & -31\\33 & 32 & -33\\33 & 31 & -32\end{bmatrix}$

(b) $\begin{bmatrix}32 & 31 & -33\\33 & 32 & -31\\33 & 31 & -32\end{bmatrix}$

(c) $\begin{bmatrix}32 & 31 & -32\\33 & 32 & -33\\33 & 31 & -31\end{bmatrix}$

(d) $\begin{bmatrix}32 & 33 & -31\\33 & 32 & -33\\33 & 31 & 32\end{bmatrix}$

53. The equation for the ellipsoid of inertia of a solid body is $P(x) \equiv 4x_1^2 + 4x_2^2 + x_3^2 - 2x_1x_2$.

What is the standard form in terms of a new orthogonal set of axes $O\{y_1, y_2, y_3\}$?

(a) $y_1^2 - 3y_2^2 + 3y_3^2$
(b) $y_1^2 + 5y_2^2 + 3y_3^2$
(c) $y_1^2 - 5y_2^2 + 3y_3^2$
(d) $y_1^2 + 5y_2^2 - 3y_3^2$

54. What is the general solution of a homogeneous differential equation with the characteristic equation?

$\lambda^3(\lambda+4)^2\left(\lambda^2+2\lambda+5\right)^2 = 0$

(a) $y(x) = c_1 + c_2x + c_3x^2 + c_4e^{-4x} + c_5xe^{4x} + e^x\{c_6\cos 2x + c_7\sin 2x + c_8x\cos 2x + c_9x\sin 2x\}$

(b) $y(x) = c_1 + c_2x + c_3x^2 + c_4e^{-4x} + c_5xe^{-4x} + e^{-x}\{c_6\cos 2x + c_7\sin 2x\} + e^x\{c_8x\cos 2x + c_9x\sin 2x\}$

(c) $y(x) = c_1 + c_2x + c_3x^2 + c_4e^{-4x} + c_5xe^{4x} + e^x\{c_6\cos 2x + c_7\sin 2x\} + e^{-x}\{c_8x\cos 2x + c_9x\sin 2x\}$

(d) $y(x) = c_1 + c_2x + c_3x^2 + c_4e^{-4x} + c_5xe^{-4x} + e^{-x}\{c_6\cos 2x + c_7\sin 2x + c_8x\cos 2x + c_9x\sin 2x\}$

55. What is the initial value if $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-x}$, with $y(0) = 2, \left(\frac{dy}{dx}\right)_{x=0} = 1$?

(a) $y(x) = \left(\frac{13}{4} + \frac{1}{2}x\right)e^{-x} - \frac{5}{4}e^{-3x}$

(b) $y(x) = \left(\frac{13}{4} + \frac{1}{2}x\right)e^{-3x} - \frac{5}{4}e^{-x}$

(c) $y(x) = \left(\frac{13}{4} + \frac{1}{2}x\right)e^{-x} + \frac{5}{4}e^{-3x}$

(d) $y(x) = \left(\frac{13}{4} - \frac{1}{2}x\right)e^{-x} - \frac{5}{4}e^{-3x}$

56. If $\mathcal{L}\{(f(t))\} = \frac{e^{-3s}(1-2s)}{2s^2 - s + 1}$, then $\mathcal{L}\{(f(3t))\} =$

(a) $\frac{e^{-s}(-3-2s)}{2s^2 - 3s + 9}$ (b) $\frac{e^{-s}(3+2s)}{2s^2 - 3s + 9}$

(c) $\frac{e^{-s}(3-s)}{2s^2-3s+9}$ (d) $\frac{e^{-s}(3-2s)}{2s^2-3s+9}$

57. What is the solution of the equation $\frac{d^2y}{dt^2}+y(t)=\int_0^t \sin\tau y(t-\tau)d\tau$ subject to the initial conditions $y(0)=1$ and $\left(\frac{dy}{dt}\right)_{t=0}=0$?

(a) $y(t)=\frac{1}{2}\left(1-\cos\sqrt{2}t\right)$, for $t>0$

(b) $y(t)=\frac{1}{2}\left(1+\cos\sqrt{2}t\right)$, for $t>0$

(c) $y(t)=\frac{1}{2}\left(-1-\cos\sqrt{2}t\right)$, for $t>0$

(d) $y(t)=-\frac{1}{2}\left(1-\cos\sqrt{2}t\right)$, for $t>0$

58. The n^{th} coefficient of a series is given by $a_n=\frac{1\cdot5\cdot9\cdot13\ldots(4n+1)}{2^n}$. What is the expression a_n in terms of the gamma function?

(a) $a_n=2^{n+2}\frac{\Gamma\left(n+\frac{5}{4}\right)}{\Gamma\left(\frac{1}{4}\right)}$

(b) $a_n=2^{n+1}\frac{\Gamma\left(n+\frac{5}{4}\right)}{\Gamma\left(\frac{1}{4}\right)}$

(c) $a_n=2^{n}\frac{\Gamma\left(n+\frac{5}{4}\right)}{\Gamma\left(\frac{1}{4}\right)}$

(d) $a_n=2^{n+3}\frac{\Gamma\left(n+\frac{5}{4}\right)}{\Gamma\left(\frac{1}{4}\right)}$

59. Fourier series representation of $f(x)=x+1$ for $-1\leqslant x\leqslant 1$ is

(a) $f(x)=1-\frac{2}{\pi}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}\sin n\pi x$

(b) $f(x)=-1-\frac{2}{\pi}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}\sin n\pi x$

(c) $f(x)=1+\frac{2}{\pi}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}\sin n\pi x$

(d) $f(x)=-1+\frac{2}{\pi}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}\sin n\pi x$

60. Let $f(x)=\begin{cases}1, & |x|<a\\ 0, & |x|>a,\end{cases}$ and $g(x)=\begin{cases}1, & 0<x<a\\ 0, & \text{otherwise},\end{cases}$ then the Fourier transform of $3f(x)-2g(x)$ is

(a) $\sqrt{\frac{2}{\pi}}\left\{\frac{3\sin\omega a}{\omega}+\left(\frac{1-e^{-i\omega a}}{i\omega}\right)\right\}$

(b) $\sqrt{\frac{2}{\pi}}\left\{\frac{3\sin\omega a}{\omega}-\left(\frac{1+e^{-i\omega a}}{i\omega}\right)\right\}$

(c) $\sqrt{\frac{2}{\pi}}\left\{\frac{-3\sin\omega a}{\omega}-\left(\frac{1-e^{-i\omega a}}{i\omega}\right)\right\}$

(d) $\sqrt{\frac{2}{\pi}}\left\{\frac{3\sin\omega a}{\omega}-\left(\frac{1-e^{-i\omega a}}{i\omega}\right)\right\}$

61. For what values of a and b is the vector field $F=(x+z)i+a(y+z)j+b(x+y)k$ a conservative field?

(a) $a=b=1$

(b) $a=b=-1$

(c) $a=1, b=-1$

(d) $a=-1, b=1$

62. Let S be the surface of the paraboloid of revolution $z=1-x^2-y^2$ with the domain of definition $x^2+y^2\leq 1$, and let Γ be the boundary of the paraboloid.

Given $F=x^3i+(x+y-z)j+yzk$.

What is the value of $\iint_S \text{curl}F\cdot dS$?

(a) 2π

(b) π

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

(d) π^2

63. The fixed point iterative scheme for determining $\sqrt{2}$ is

(a) $x_{n+1} = \frac{1}{2}\left(x_n - \frac{2}{x_n}\right)$

(b) $x_{n+1} = \frac{1}{2}\left(-x_n + \frac{2}{x_n}\right)$

(c) $x_{n+1} = -\frac{1}{2}\left(x_n + \frac{2}{x_n}\right)$

(d) $x_{n+1} = \frac{1}{2}\left(x_n + \frac{2}{x_n}\right)$

64. The Gauss-Seidel iterative method for the system of equations

$-\frac{1}{4}x_2 - \frac{1}{4}x_3 + x_4 = \frac{1}{4}$

$-\frac{1}{4}x_1 + x_3 - \frac{1}{4}x_4 = \frac{1}{4}$,

$x_1 - \frac{1}{4}x_2 - \frac{1}{4}x_3 = \frac{1}{2}$,

$-\frac{1}{4}x_1 + x_2 - \frac{1}{4}x_4 = \frac{1}{2}$ is

(a) $x_1^{(n+1)} = 0\cdot5 - 0\cdot25x_2^{(n)} + 0\cdot25x_3^{(n)}$,
$x_2^{(n+1)} = 0.5 + 0.25x_1^{(n+1)} + 0\cdot25x_4^{(n)}$
$x_3^{(n+1)} = 0\cdot25 + 0\cdot25x_1^{(n+1)} + 0\cdot25x_4^{(n)}$,
$x_4^{(n+1)} = 0\cdot25 - 0\cdot25x_2^{(n+1)} + 0\cdot25x_3^{(n+1)}$

(b) $x_1^{(n+1)} = 0\cdot5 + 0\cdot25x_2^{(n)} + 0\cdot25x_3^{(n)}$,
$x_2^{(n+1)} = 0\cdot5 + 0\cdot25x_1^{(n+1)} + 0\cdot25x_4^{(n)}$,
$x_3^{(n+1)} = 0\cdot25 + 0\cdot25x_1^{(n+1)} + 0\cdot25x_4^{(n)}$,
$x_4^{(n+1)} = 0\cdot25 + 0\cdot25x_2^{(n+1)} + 0\cdot25x_3^{(n+1)}$

(c) $x_1^{(n+1)} = 0.5 + 0\cdot25x_2^{(n)} + 0.25x_3^{(n)}$,
$x_2^{(n+1)} = 0\cdot5 + 0\cdot25x_1^{(n+1)} - 0.25x_4^{(n)}$,
$x_3^{(n+1)} = 0.25 + 0.25x_1^{(n+1)} - 0.25x_4^{(n)}$,
$x_4^{(n+1)} = 0\cdot25 + 0\cdot25x_2^{(n+1)} + 0\cdot25x_3^{(n+1)}$

(d) $x_1^{(n+1)} = 0\cdot5 + 0\cdot25x_2^{(n)} - 0\cdot25x_3^{(n)}$,
$x_2^{(n+1)} = 0.5 - 0.25x_1^{(n+1)} + 0.25x_4^{(n)}$
$x_3^{(n+1)} = 0\cdot25 + 0\cdot25x_1^{(n+1)} + 0\cdot25x_4^{(n)}$,
$x_4^{(n+1)} = 0\cdot25 + 0\cdot25x_2^{(n+1)} + 0\cdot25x_3^{(n+1)}$

65. What is the missing figure in the following table?

x	1	2	3	4	5
y = f(x)	2	5	7	-	32

(a) 10 (b) 13
(c) 14 (d) 17

66. What is $f'(0\cdot2)$ from the following tabular data?

x	1	2	3	4	5
y = f(x)	2	5	7	-	32

(a) 4.2 (b) 2.2
(c) 5.2 (d) 3.2

67. Of the five boys A, B, C, D and E two are good, one is poor and two are average in studies. Two of them study in post-graduate classes and three in under graduate classes. One comes from a rich family, two from middle class families and two from poor families. One of them is interested in music, two in acting and one in sports. Of those studying in under graduate classes, two are average and one is poor in studies. Of the two boys interested in acting, one is a post-graduate student. The one who is interested in music comes from a middleclass family. Both of the boys interested in acting are not industrious, good in studies, come from middle class families, are average in studies and one of them is interested in acting. The boy interested in sports comes from a poor family, while the one interested in music is industrious. E is industrious, good in studies comes from a poor family and is not interested in acting, music or sports. C is poor in studies in spite of being industrious. A comes from a rich family, is not industrious but good in studies. B is industrious and comes from a middleclass family. Name the boy who is

not industrious and is average in studies.
(a) A
(b) B
(c) C
(d) D

68. At an electric Data Processing Unit five out of the eight program sets P, Q, R, S, T, U, V and W are to be operated daily. On any one day except for the first day of the month only three of the program sets must be the ones that were operated on the previous day. The program operating must also satisfy the following conditions :
1. If program is to be operated on a day, cannot be operated on that day.
2. If is to be operated on a day, must be one of the programs to be operated after.
3. If is to be operated on a day, must be one of the programs to be operated after.
4. The last program to be operated on any day must be either or.

If the program sets R and W are to be operated on the first day which of the following could be the other programs on that day?
(a) Q, V, S (b) Q, T, V
(c) T, S, U (d) T, S, V

69. Read the following information carefully and answer the question given below it:
1. Eight doctors P, Q, R, S, T, U, V and W visit a charitable dispensary every day except on a holiday i.e., Monday.
2. Each doctor visits for one hour from Tuesday to Sunday except Saturday. The timings are 9 A.M. to 1 P.M. and 2 P.M. to 6 P.M., 1 P.M. to 2 P.M. is lunch break
3. On Saturday it is opened only in the morning i.e., 9 A.M. to 1 P.M. and each doctor visits for only half an hour.
4. No other doctor visits the dispensary before doctor Q and after U.
5. Doctor W comes immediately after the lunch break and is followed by R.
6. S comes in the same order as P in the afternoon session.

If the lunch break and subsequent visiting hours are reduced by 15 minutes, at what time doctor U is expected to attend the dispensary
(a) 3.15 P.M.
(b) 4 P.M
(c) 4.15 P.M
(d) 4.45 P.M.

70. Study the following information carefully and answer the question given below it:
1. P, Q, R, S, T and U are six members in a family in which there are two married couples.
2. T, a teacher, is married to the doctor who is mother of R and U.
3. Q, the lawyer, is married to P.
4. P has one son and one grandson.
5. Of the two married ladies one is housewife.
6. There is one student and one male engineer in the family

How is R related to U?
(a) Brother only (b) Sister only
(c) Brother or Sister (d) Mother

71. Read the following information carefully and answer the question that follow:
1. Madhu and Shobha are good in Dramatics and Computer Science.
2. Anjali and Madhu are good in Computer Science and Physics.
3. Anjali, Poonam and Nisha are good in Physics and History.
4. Nisha and Anjali are good in Physics and Mathematics.
5. Poonam and Shobha are good in History and Dramatics.

Who is good in History, Physics, Computer Science and Mathematics?
(a) Poonam (b) Nisha
(c) Madhu (d) Anjali

72. The question given below has three statements followed by three conclusions numbered I, II and III. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts
Statements:
All lions are tigers.

All tigers are leopards.
Some leopards are wolves.
Conclusions :
I. No elephant is lion.
II. Some wolves are lions.
III. Some leopards are lions.
(a) Only I follows
(b) Only II follows
(c) Only III follows
(d) Only I and III follow

73. Rohith went 15 km to the west from his house, then he turned left and walked 20 km. He then turned east and walked 25 km and finally turning left covered 20 km. How far is he from his house?
(a) 5 km
(b) 10 km
(c) 40 km
(d) 80 km

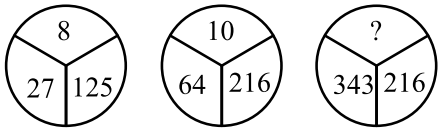
74. Cryptic language is popular since ages, mostly in the field of espionage and sending classified messages. If 'I LOVE YOU' is coded as 7, then how would you code 'GO TO HELL' in the same language?
(a) 1 (b) 4
(c) 3 (d) 5

75. What letter should replace the question mark?

J	A	G	H
L N	E I	M S	P ?

(a) Z
(b) Y
(c) X
(d) W

76. In the first two circles, the number inside the circle is written according to a particular relation. What is the number inside the third circle which follows the same relation as that of the first two circles?



(a) 12
(b) 13
(c) 9
(d) 14

77. Deepthi is playing a treasure hunt game. At the first stage, Deepthi needs to choose a five-digit code to unlock the vault which contains the treasure. She gets the following codes to choose from

15342	26540	35412
23105	15320	13402
35047	71024	28305

The following clues are given to her to help her to find the code.
P. The code number is not an even number.
Q. The product of the first two digits is odd.
R. The sum of the first four digits is 12.
S. The code number is not a multiple of 5.
If Deepthi had the option of selecting only one clue, which of the four clues will give her the best chance of finding out the five-digit code?
(a) S
(b) R
(c) Q
(d) P

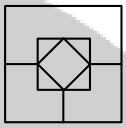
78. Suppose you enter an elevator at a certain floor. Then the elevator moves up 5 floors, down 3 floors, and up 2 floors. If you are then at the 8th floor, on what floor did you first enter the elevator?
(a) 8
(b) 7
(c) 6
(d) 9

79. A number series is given with one term missing. Choose the correct alternative from the options.

0.5, 0.55, 0.65, 0.8, ?

(a) 0.9
(b) 0.95
(c) 0.82
(d) 1

80. The soccer club is putting together a mural using lightly colored transparent paper. This paper then is cut into squares of different sizes that are placed next to each other to make the designs for the mural. Of course, the club wants to save money, so its members are trying to buy the minimum number of sheets of colored paper. Below is one of the designs they are going to use. What is the minimum number of squares they will need to make this design?



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

81. What is the correct alternative for the question mark?

2, 3, 8, 63, ?

(a) 1038 (b) 1998
(c) 3008 (d) 3968

82. Which one of the following is NOT an objective of Mahila Kisan Sashakti-karan Pariyojana (MKSP)?

(a) To create sustainable agricultural livelihood opportunities for women in agriculture
(b) To ensure food and nutrition security at the household and the community level
(c) To enable women to have better access to inputs and services of the government agencies and other
(d) To help women educate the rural folk and improve their living condition

83. Consider the following statements regarding the aim of Jal Jeevan Mission to provide every rural household of the country with adequate tap water of prescribed quality on regular basis:

1. It seeks to ensure 'ease of living' which leads to healthier as well as hygienic living conditions in rural areas.
2. It aims to establish water tanks in good numbers with the slogan 'Har Ghar Jal'.
3. By ensuring community participa- tion at village-level, it will help in developing

local leadership based on Gandhiji's philosophy of 'Gram Swarajya'.

4. The Mission seeks to achieve its goal by 2024.

Which of the following statements are correct?

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

84. Which one of the following is NOT correctly matched?

(a) The Last Queen : Chitra Banerjee Divakaruni
(b) Inseparable : Simone de Beauvior
(c) Great Circle: Rumaan Alam
(d) Jungle Nama : Amitav Ghosh

85. What is 'The Pandora Papers'?

(a) It is the document related to the top 100 highest tax payers of the world
(b) It is the project of investigation which leaked almost 12 million documents that reveals hidden wealth, money laundering by some of the world's rich and powerful
(c) It is the record of total revenue collected at the world level
(d) It is the document containing record of the top young talented entrepreneurs under the age 30

86. Match the following:

	List I	List II	
P.	V Shanta	1.	Film director
Q.	Akhtar Ali	2.	Former Davis Cup coach
R.	Anil Dharkar	3.	Noted journalist
S.	Sumitra Bhave	4.	Renowned Indian oncologist

Select the correct pair using the code given below:

(a) P-4, Q-2, R-3, S-1
(b) P-2, Q-4, R-1, S-3
(c) P-3, Q-1, R-2, S-4
(d) P-1, Q-3, R-4, S-2

87. Select the State/s and/or UTs of India which have been ranked first as 'Zero Hunger' as per SDG : India Agenda for Development :

(a) Tamil Nadu and Delhi
(b) Raja J V Chari
(c) Kerala and Chandigarh
(d) Pankaj Lokhani

88. Which one of the following pairs is NOT correct under women achievers?

(a)	Megha Rajagopalan	Winner of Pultizer prize in feature writing
(b)	Anvee Bhutani	Indian-origin student elected as the preisdent of Oxford Student Union
(c)	Delisha Davis	24 year old female heavy vehicle driver carrying hazardous goods
(d)	Bela M Trivedi	Took oath as the Judge of the Supreme court of India

89. Who among the following is India's first Space Tourist?

(a) Santosh George Kulangara
(b) Sirisha Bandla
(c) Raja J V Chari
(d) Pankaj Lokhani

90. The Wassenaar Arrangement is

(a) an elite club of countries which subscribe to arms export controls
(b) a group of countries concerned with unconventional energy sources in the world
(c) concerned with the preservation of extinct animal species
(d) an arrangement which seeks to study recurring cyclone patterns

91. Which one of the following is NOT included in the 12 areas of "Doing Business 2020"?

(a) Getting credit
(b) Paying taxes
(c) Promoting small scale industries
(d) Getting electricity

92. Consider the following economic activities :
1. Public administration
2. Financial services
3. Mining and quarrying

Which of the above economic activities fall under the tertiary sector?
(a) 1 and 3 only
(b) 1, 2 and 3
(c) 2 and 3 only
(d) 1 and 2 only

93. IMF raises its projection for economic growth in 2021-22 to
(a) 11.3% (b) 12.5%
(c) 10.2% (d) 8.4%

94. Consider the following statements:
1. Ford India will stop manufacturing vehicles in India but will retain the engine-making and technology services business as part of restructuring its India operations.
2. Zee Entertainment Enterprises Ltd announces a merger with Sony Pictures Networks India.
3. Yashoda Hegde is the new CEO of Coffee Day Enterprises Ltd.

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

95. Government of India has moved a resolution in UN General Assembly to declare the year 2023 as the International Year of Millets for which of the following reasons?
1. Support will be provided for post-harvest value addition, enhancing domestic consumption.
2. Support will be provided for branding millet products nationally and internationally.

Select the correct answer using the code given below:
(a) 1 only
(b) Neither 1 nor 2
(c) Both 1 and 2
(d) 2 only

96. 'Bahujan Hitaya: Bahujan Sukhaya' is the motto of
(a) Central Board of Film Certification
(b) Indian Railways
(c) Doordarshan
(d) All India Radio

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:

97. Statement (I) : The machine shop produces parts machined from stock material and finishes castings, forgings, etc., requiring machined surfaces.
Statement (II) : In machine shops, machining operations remove metal, either to make a smoother and more accurate surface, as by planning, facing, milling, etc. or to produce a surface previously existing, as by drilling, punching, etc
(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

98. Statement (I) : Ozone depletions are mostly harmful to biological systems in a variety of ways.
Statement (II): Ozone depletion in stratosphere leads to the loss of filtering ability of UV light.
(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

99. Statement (I): Alterations in both, physico-chemical (abiotic) and biological (biotic) components of the biosphere by mankind resulted in environmental degradation world over.

Statement (II) : Major environmental problems are in fact the manifestations of the degraded environments at global level.

(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

100. Statement (I) : Ethics involves the discipline of systematic enquiry into moral norms of standards of behavior and their underlying values and justification.

Statement (II) : Applied ethics looks into the ways in which moral value can be applied to particular areas of concern such as business.

(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

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