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ESE 2023 : Prelims Exam | GS & ENGINEERING CLASSROOM TEST SERIES | APTITUDE Test 7

Section A : Basics of Project Management [All Topics]

Section B : General Principles of Design, Drawing, Importance of Safety [All Topics]

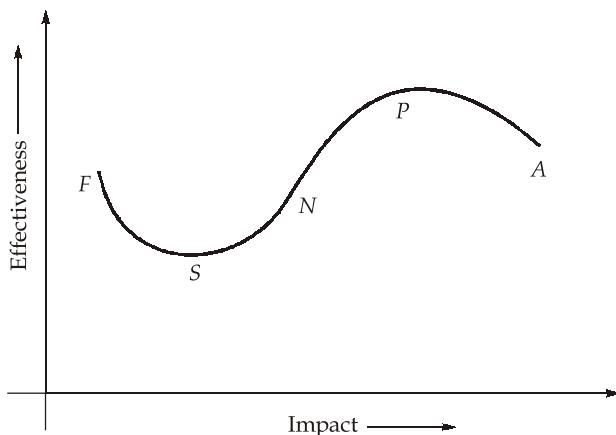
Section C : Basics of Energy and Environment [All Topics]

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|---------|---------|---------|---------|---------|
| 1. (d) | 11. (a) | 21. (b) | 31. (c) | 41. (d) |
| 2. (d) | 12. (d) | 22. (d) | 32. (c) | 42. (b) |
| 3. (c) | 13. (c) | 23. (a) | 33. (a) | 43. (b) |
| 4. (d) | 14. (c) | 24. (d) | 34. (d) | 44. (a) |
| 5. (b) | 15. (c) | 25. (a) | 35. (b) | 45. (c) |
| 6. (d) | 16. (b) | 26. (c) | 36. (a) | 46. (a) |
| 7. (b) | 17. (d) | 27. (b) | 37. (d) | 47. (d) |
| 8. (b) | 18. (c) | 28. (a) | 38. (b) | 48. (b) |
| 9. (b) | 19. (d) | 29. (a) | 39. (d) | 49. (c) |
| 10. (b) | 20. (b) | 30. (d) | 40. (a) | 50. (d) |

DETAILED EXPLANATIONS

1. (d)

Tuckman's model,

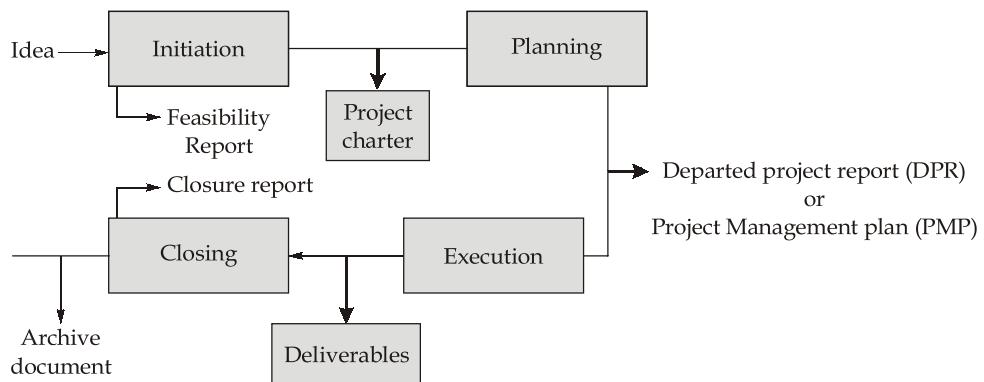


Forming → Storming → Norming → Performing → Adjourning.

Team's effectiveness initially decreases from forming to storming, then increases from storming to performing and then again decreases from performing to adjourning.

Team's effectiveness is least in storming stage and highest in performing stage.

2. (d)



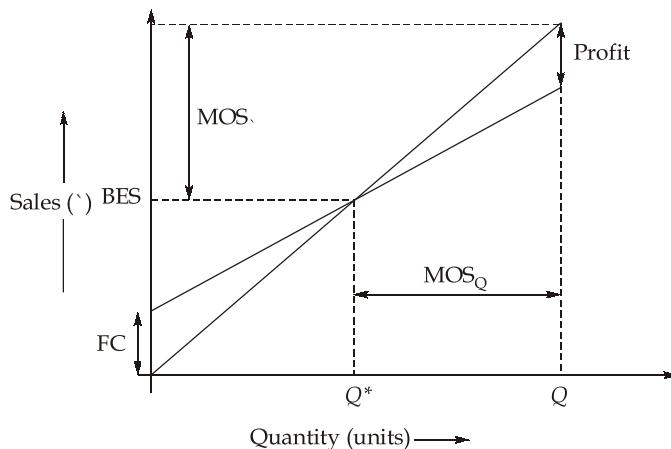
3. (c)

Given :

$$SQ = ₹50 \text{ lakhs}$$

$$\frac{P}{V} = \frac{S - C}{S} = 0.5$$

Margin of safety, MOS = ₹20 lakhs



$MOS_{₹}$ = Margin of safety (in rupees)

MOS_Q = Margin of safety in terms of quantity

From similar triangles,

$$\frac{\text{Profit}}{\text{FC}} = \frac{\text{MOS}_Q}{Q^*}$$

$$\frac{\text{Profit}}{\text{FC}} = \frac{S \times \text{MOS}_Q}{S \times Q^*} = \frac{\text{MOS}_{₹}}{\text{BES}}$$

∴

$$\frac{\text{Profit}}{\text{FC}} = \frac{\text{MOS}_Q}{Q^*} = \frac{\text{MOS}_{₹}}{\text{BES}}$$

$$\Rightarrow \frac{Q - Q^*}{Q^*} = \frac{₹20 \text{ lakh}}{\text{BES}} \quad \{ \because \text{MOS}_Q = Q - Q^* \}$$

$$\frac{Q}{Q^*} - 1 = \frac{₹20 \text{ lakh}}{SQ^*}$$

$$\frac{SQ}{SQ^*} - 1 = \frac{₹20 \text{ lakh}}{SQ^*}$$

$$\frac{₹50 \text{ lakh}}{SQ^*} - \frac{₹20 \text{ lakh}}{SQ^*} = 1$$

$$\Rightarrow SQ^* = ₹30 \text{ lakh}$$

$$\therefore \text{BES} = ₹30 \text{ Lakh}$$

$$\text{Now, } \frac{S - C}{S} = 0.5$$

$$\frac{(S - C)Q^*}{SQ^*} = 0.5$$

$$₹30 \text{ lakh} - CQ^* = 0.5 \times SQ^* = 0.5 \times ₹30 \text{ lakh}$$

$$CQ^* = ₹15 \text{ lakh}$$

$$\text{Now, } \text{Fixed cost} + CQ^* = SQ^*$$

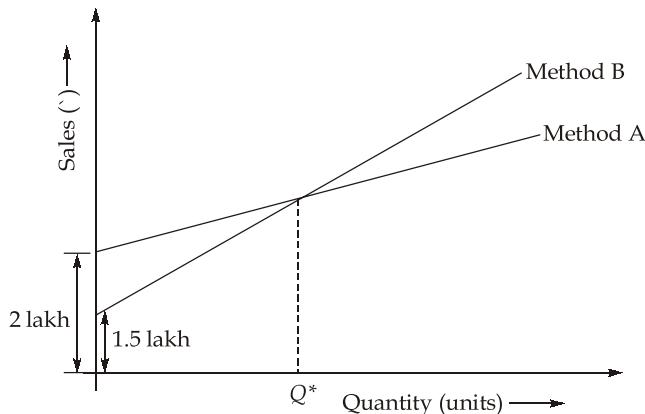
\therefore Fixed cost (F.C.) = ₹30 lakh - ₹15 lakh = ₹15 lakh

$$\text{From similar triangles, } \frac{\text{Profit}}{\text{FC}} = \frac{\text{MOS}_\text{₹}}{\text{BES}}$$

$$\Rightarrow \frac{\text{Profit}}{\text{₹15lakh}} = \frac{\text{₹20lakh}}{\text{₹30lakh}}$$

$$\Rightarrow \text{Profit} = \text{₹10Lakh}$$

4. (d)



$$\text{₹}2\text{lakh} + 100Q^* = \text{₹}1.5\text{lakh} + 300Q^*$$

$$\text{₹}0.5 \times 10^5 = 200Q^*$$

$$Q^* = 250 \text{ pieces}$$

For example of $Q = 249$

$$\Rightarrow \text{Total cost for method A} \rightarrow \text{₹}2 \times 10^5 + \text{₹}100 \times 249 = \text{₹}2,24,900$$

$$\text{Total cost for method B} \rightarrow \text{₹}1.5 \times 10^5 + \text{₹}300 \times 249 = \text{₹}2,24,700$$

If $Q = 251$

$$\Rightarrow \text{Total cost for method A} \rightarrow \text{₹}2 \times 10^5 + \text{₹}100 \times 251 = \text{₹}2,25,100$$

$$\text{Total cost for method B} \rightarrow \text{₹}1.5 \times 10^5 + \text{₹}300 \times 251 = \text{₹}2,25,300$$

For $Q < 250 \rightarrow$ Choose method B

For $Q > 250 \rightarrow$ Choose method A

5. (b)

$$\text{ARR} = \frac{\text{Average annual profit}}{\text{Initial investment}}$$

$$\begin{aligned} \text{Total profit} &= \text{₹}(150 + 220 + 300 + 250 + 180 + 150) \times 10^3 - \text{₹}650 \times 10^3 \\ &= \text{₹}600000 \end{aligned}$$

$$\text{Average profit} = \frac{\text{₹}600000}{6} = \text{₹}100000$$

$$\text{ARR} = \frac{\text{₹}100000}{\text{₹}650000} \times 100 = 15.4\%$$

6. (d)

Applicable interest rate for 2 years is 12%

$$\text{Future value, } FV = PV(1 + i')^{n'}$$

Quarterly means earning once in 3 months.

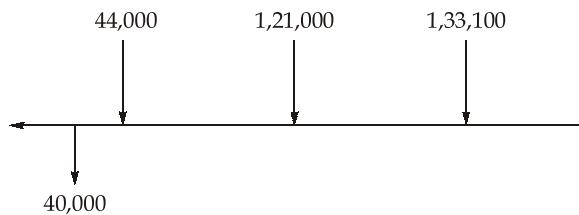
$$i' = \frac{i}{12} \times 3 = \frac{0.12}{12} \times 3 = 0.03$$

$$n' = n \times 4 = 2 \times 4 = 8$$

$$FV = 1000(1 + 0.03)^8$$

$$FV = 1000 \times (1.03)^8$$

7. (b)



$$\begin{aligned}\text{Net present value, NPV} &= \frac{44000}{1.1} + \frac{121000}{(1.1)^2} + \frac{133100}{(1.1)^3} - 40000 \\ &= ₹200000\end{aligned}$$

8. (b)

$$A = P \left[\frac{i(1+i)^n}{(1+i)^n - 1} \right]$$

$$\text{Capital recovery factor (CRF)} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$i + SFF = CRF$$

$$CRF = 0.15 + 0.148 = 0.298$$

$$\begin{aligned}A &= 100000 \times 0.298 \\ &= ₹29800\end{aligned}$$

9. (b)

$$C = \frac{i(1-t) + \left(\frac{FV - PV}{n} \right)}{\left(\frac{FV + PV}{2} \right)}$$

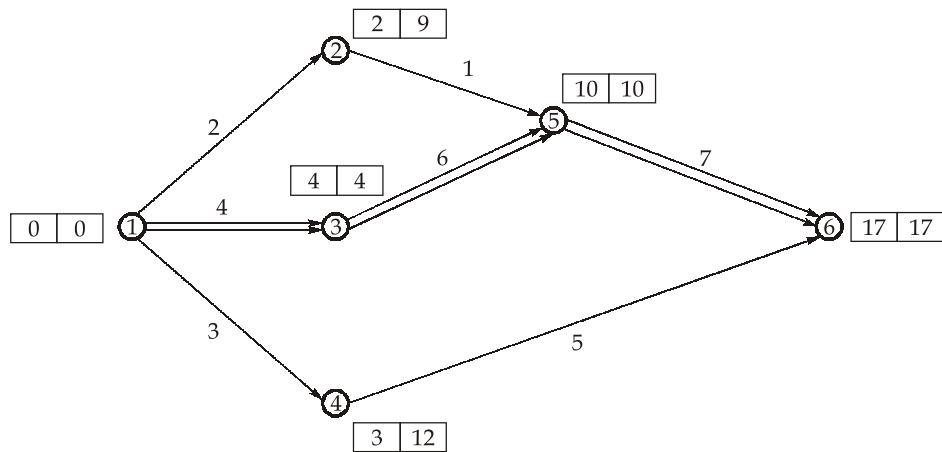
$$C = \frac{0.14 \times 100 \times (1 - 0.5) + \left(\frac{105 - 97}{8} \right)}{\left(\frac{105 + 97}{2} \right)}$$

$$C = 0.079 = 7.9\%$$

10. (b)

- Work breakdown structure (WBS) is pictorial representation (not graphical).
 - It is suitable for big projects under complex conditions.
 - The major project is first identified in terms of its end items, then split into system, sub systems, then their components and elements.

11. (a)



Critical path : 1 - 3 - 5 - 6

$$\begin{aligned}\text{Variance along the critical path } (\sigma^2) &= \left(\frac{7-1}{6}\right)^2 + \left(\frac{14-2}{6}\right)^2 + \left(\frac{15-3}{6}\right)^2 \\&= 1 + 4 + 4 \\&= 9\end{aligned}$$

Standard deviation, σ = 3 days

Probability that the project will finish by the end of day 19,

$$Z = \frac{19 - 17}{3} = 0.67$$

Probability = 74.9%

Probability of completion before day 15 = Probability of completion in 14 days

$$Z = \frac{14 - 17}{3} = -1$$

$$\text{Probability} = 100 - 84.1 = 15.9\%$$

Probability of completion on 17th day = Probability of completion in 17 days - Probability of completion in 16 days

Probability of completion in 17 days = 50%

$$\text{Probability of completion in 16 days, } Z = \frac{16 - 17}{3} = \frac{-1}{3} = -0.34$$

$$\text{Probability} = 100 - 63.33 = 36.67\%$$

Probability of completion on 17th day = 50 - 36.67 = 13.33%

Probability that the project will finish no later than the 20th day = Probability of completion in 20 days

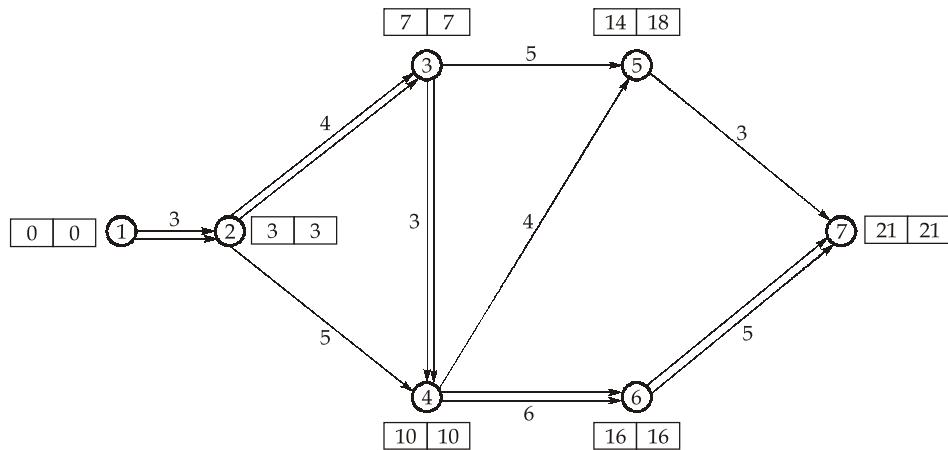
$$t = \frac{20 - 17}{3} = 1$$

Probability = 84.1%

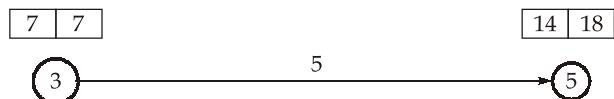
12. (d)

- Independent float, F_{ID} = (Free float) – Slack at tail event
- Slack is zero for critical activity is wrong statement since slack is associated with events.
Slack is minimum for critical events.

13. (c)



For activity, 3 - 5,



$$\text{EST} = 7$$

$$\text{EFT} = 7 + 5 = 12$$

$$\text{LST} = 18 - 5 = 13$$

$$\text{LFT} = 18$$

$$\begin{aligned} \text{Total float, } F_T &= \text{LST} - \text{EST} = \text{LFT} - \text{EFT} \\ &= 13 - 7 = 18 - 12 = 6 \text{ days} \end{aligned}$$

$$\text{Free float, } F_F = F_T - \text{Slack at head event}$$

$$F_F = 6 - 4 = 2 \text{ days}$$

$$\text{Independent float, } F_{ID} = F_F - \text{Slack of tail event}$$

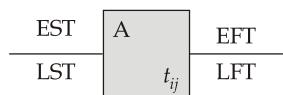
$$F_{ID} = 2 - 0 = 2 \text{ days}$$

$$\text{Interfering float, } F_{IN} = F_T - F_F$$

$$F_{IN} = 6 - 2$$

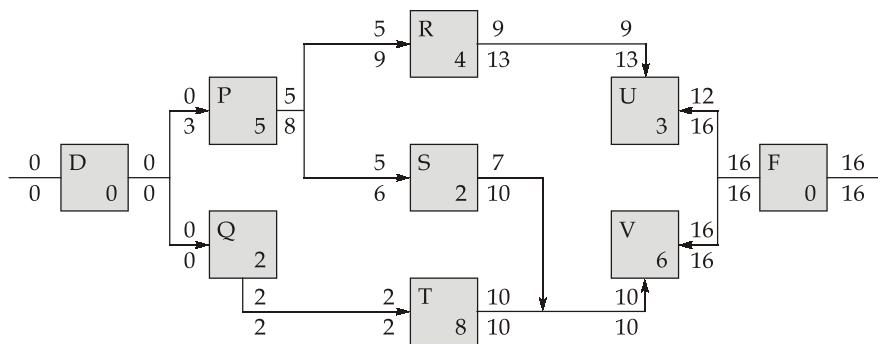
$$F_{IN} = 4 \text{ days}$$

14. (c)



D : Debut activity

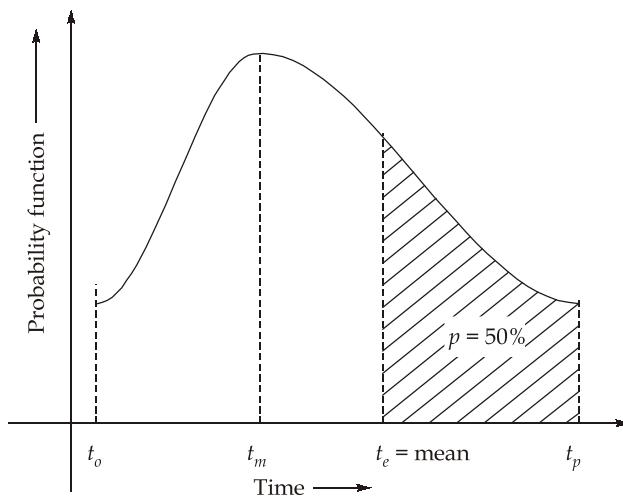
F : Finish activity



∴

Project duration = 16 days

15. (c)



16. (b)

- Resource smoothing is applied if duration of completion of the project is the constraint.
- The periods of minimum demand for resources are located and the activities are shifted according to the float availability and requirement of resources.
- On the other hand, resource levelling is done if the restriction is on the availability of resources. In this process of resource levelling, whenever the availability of resources becomes less than its maximum requirement, the only alternative is to delay the activity having larger float.

17. (d)

Unit price contract : This is based on estimated quantities of the items involved in the work. The contractor is obligated to perform the quantities of the work actually required in the field at his quoted prices, whether they are greater or less than the owner's estimates. This method is also called K-2 form of contract.

20. (b)

$$F_t = F_{t-1} + \alpha(D_{t-1} - F_{t-1})$$

∴

$$F_{\text{Feb}} = F_{\text{Jan}} + \alpha(D_{\text{Jan}} - F_{\text{Jan}})$$

$$F_{\text{Feb}} = 400 + 0.25(500 - 400)$$

$$F_{\text{Feb}} = 425$$

Now,

$$F_{\text{March}} = 425 + 0.25(600 - 425)$$

$$= 468.75 \text{ units}$$

21. (b)

Triple constraints = Time - Cost - Scope

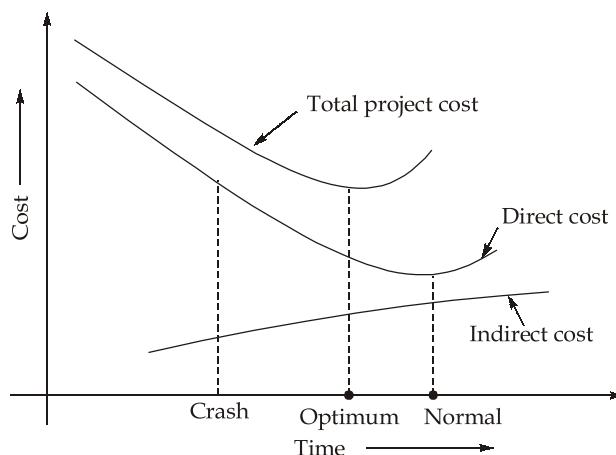
Diamond constraints = Time - Cost - Scope - Quality

PMBok's constraints = Time - Cost - Scope - Quality - Risk - Resource

22. (d)

$$\begin{aligned} \text{Cost of loan} &= \frac{i(1-t)}{NP} \\ &= \frac{0.12 \times 10 \times 10^7 \times (1-0.45)}{10 \times 10^7} \\ &= 0.066 = 6.6\% \end{aligned}$$

23. (a)



Direct cost increases on either side of normal duration but at a steady rate on the higher side of normal duration. The time beyond which the direct cost will not be reduced with the increase in time is normal time.

Indirect cost increases with duration.

24. (d)

If the work is assigned as given in statement I, it will become difficult to identify the contractor who has not carried out the work as per specifications, if it is found at a later stage that the RCC construction has defects.

Thus, laying of cement concrete and fixing of reinforcement in the form of steel bars of the given design and specifications are to be treated as one work package.

25. (a)

Stakeholders influence is highest in the initial stage of project. Changes can be made and cost of changes made in the initial stages is less. On the other hand, cost of changes increases as the project progresses due to which the stakeholders influence reduces in the later stages.

26. (c)

Reverse engineering appears to be an unfair practice.

27. (b)

Adaptive design is a type of design in which a known solution is used to satisfy a different need or to produce a novel application.

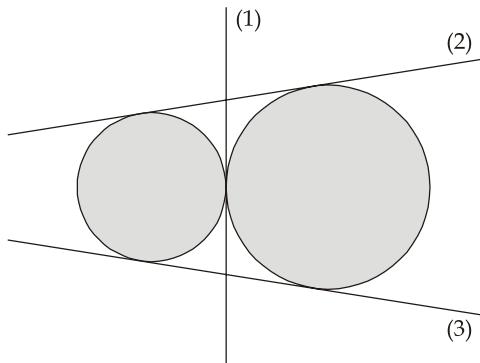
28. (a)

- Inspiration is a process in which a solution or a path towards the solution emerges.
- Verification is a process in which the inspired solution is checked against the desired result.

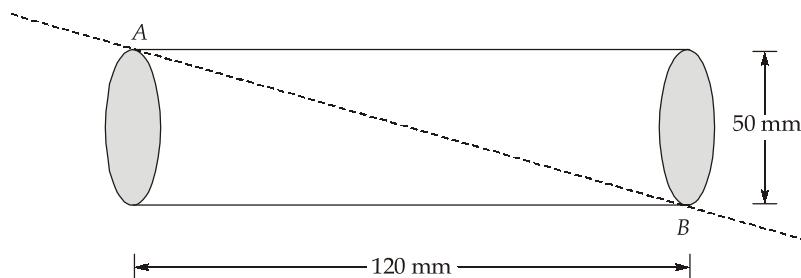
29. (a)

In EVAD, the profiles are compared in a qualitative manner rather than quantitative manner.

31. (c)



32. (c)



$$\begin{aligned}\text{Major axis} &= AB = \sqrt{(50)^2 + (120)^2} \\ &= 130 \text{ mm}\end{aligned}$$

33. (a)

- In oblique projection, the object is aligned such that one face (front face) is parallel to the projection plane. In such projection, the projectors are not perpendicular to the plane of projection rather inclined to the plane of projection at 30° , 45° or 60° .
- In perspective projection, projectors are not parallel rather converges at a point must coincide with the observer's eye.

35. (b)

Both are individually correct statements without any relation between them.

38. (b)

Both the statements are correct but they are not related to each other.

42. (b)

Eutrophication results in depletion of oxygen in water bodies which result in fatalities of aquatic animals.

43. (b)

IUCN has Official Observer Status at the United Nations General Assembly.

44. (a)

Hemis National Park is the largest National Park in India covering an area of 4400 square km.

45. (c)

Under the new rules, Government can approve handover of forest and collect payment from private developer even before State Government obtains the approval of forest dwellers.

49. (c)

REDD+ is a voluntary climate mitigation path.

50. (d)

Algae, fungi and simple plants are the first organisms to colonize an area in primary succession.

