

GATE | PSUs



CIVIL ENGINEERING

Construction Materials & Management

Text Book & Work Book : Theory with worked out Examples
and Practice Questions



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02. Construction Management**07. Ans: (a)**

Sol: Site order book is used for recording instructions given by executive engineers.

27. Ans: (b)

Sol: Feasibility studies are preliminary studies undertaken in the very early stage of a project. They are used to determine the viability of an idea, such as ensuring a project is legally and technically feasible as well as economically justifiable.

33. Ans: (a)

Sol: In cost plus fixed fee contract, the owner pays the contractor an agreed amount over and above the documented cost of work

34. Ans: (a)**Sol:**

- Guaranteed maximum price contract is a cost-type contract where the contractor is compensated for actual costs incurred plus a fixed fee subject to ceiling price.
- Savings, if any, are returned to the owner.
- It is different from lump-sum contract where cost savings are retained by contractor.

36. Ans: (c)**Sol: Turn key contract:**

An agreement under which a contractor completes a project, then hands it over in fully operational form to the client, which needs nothing to do but 'turn a key' to set it in motion.

Generally 'turnkey' refers to ready for immediate use.

37. Ans: (d)

Sol: When work is to be completed very quickly (or) no contractor prefers to accept the work (The tender is floated) then a notice with short duration is again published by the client. Such a tender notice is called 'Short tender notice'. The terms and conditions remain the same as that of ordinary tender notice.

38. Ans: (b)**Sol: Limited or Closed tender:**

In limited tenders, only pre-qualified bidders are allowed to participate. These tenders are not advertised in newspapers.

40. Ans: (a)**Sol: Earnest money deposit (E.M.D)**

While submitting a tender the contractor is to deposit a certain amount, about 2% of the contract value, as EMD as guarantee of the

tender. The amount is for a check so that the contractor may not refuse to accept the work or run away when his tender is accepted.

41. Ans: (b)

Sol: Security deposit:

On acceptance of the tender, the contractor has to deposit 10% of the tendered amount as security deposit which is inclusive of the earnest money already deposited.

It is refunded to the contractor after the satisfactory completion of the whole work after a specified time (generally after maintenance period).

43. Ans: (d)

Sol: The important resources used in construction are

1. Men (labour)
2. Material
3. Money
4. Machinery

46. Ans: (c)

Sol: ABC analysis:

ABC analysis is a simple analytical management tool for establishing economic stock level.

It is a technique of categorizing inventory items according to their substantial impact on the overall expenditure of an organization.

47. Ans: (b)

Sol: Safe stock level is used to describe a level of extra stock that is maintained to mitigate risk of stock outs (shortfall in raw material) caused by uncertainties in supply and demand. It is dependent upon rate of usage and probability of shortage.

55. Ans: (b)

Sol: Public works department (P.W.D) has a Chief Engineer who is the administrative head of the department.

56. Ans: (d)

Sol: The whole area and work under Chief Engineer is divided into number of circles. Each circle is headed by a Superintending Engineer (S.E)

57. Ans: (b)

Sol: Each circle in P.W.D is divided into number of divisions which are the executive units of the department. Each division is headed by Executive Engineer (E.E) or Divisional Engineer.

59. Ans: (c)

Sol: The accounts of a division are audited by the Accountant General.

64. Ans: (b)

Sol: Cash Book (C-Book):

A book in which receipts and payments of money are recorded.

72. Ans (b)

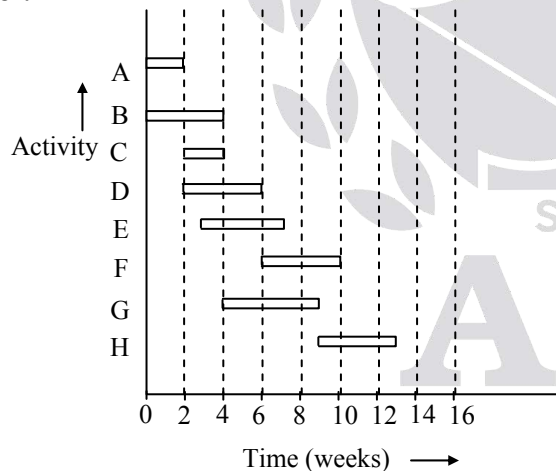
Sol:

- Estimate is a computation or calculation of the quantities required and expenditure likely to be incurred in the construction of a work. It involves calculation of large number of unit rates to produce a priced bill of quantities.
- Valuation is the technique determining the fair price or value of a property. The present value of property can be known by valuation.

03. Introduction to Project Management

07. Ans: 13 weeks

Sol:



Total completion time of period = 13 weeks

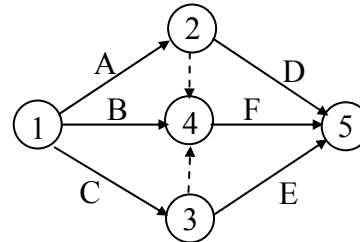
08. Ans: (c)

Sol: One of the limitations of bar charts is lack of details. Hence, it can not differentiate critical and non-critical activities.

04. Elements of Networks

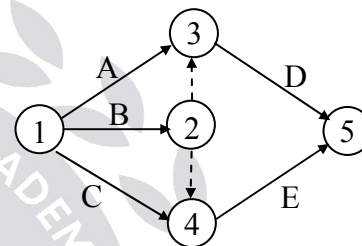
12.

Sol:



13.

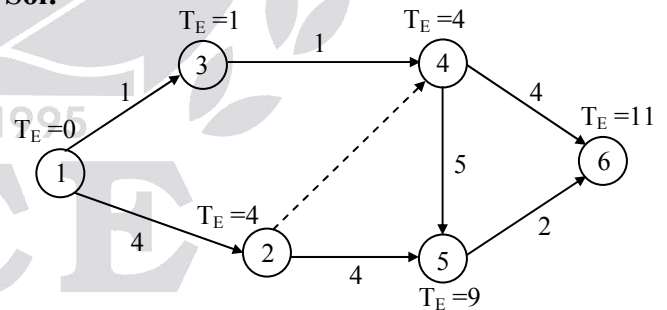
Sol:



05. CPM

27. Ans: (c)

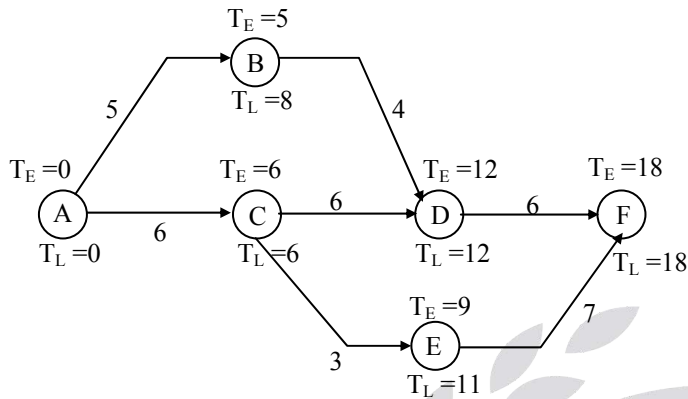
Sol:



∴ Earliest start time for activity 5 – 6 = 9 days

29. Ans: (c)

Sol:



$$F_{T(AB)} = LST - EST$$

$$EST = 0$$

$$LST = 8 - 5 = 3$$

$$F_{T(AB)} = 3$$

$$F_{T(CE)} = LST - EST$$

$$= (11 - 3) - 6 = 2$$

$$F_{F(EF)} = (T_E^j - T_E^i) - t^{ij}$$

$$= (18 - 9) - 7 = 2$$

06. PERT

13. Ans: (a)

$$\text{Sol: } t_E = \frac{t_o + 4t_L + t_P}{6}$$

$$= \frac{8 + 4 \times 9 + 13}{6} = 9.5$$

$$\text{Variance, } \sigma^2 = \left(\frac{t_P - t_o}{6} \right)^2$$

$$= \left(\frac{13 - 8}{6} \right)^2$$

$$\sigma^2 = \frac{25}{36}$$

29. Ans: 50% & 95.2%

Sol:

(a) $T_E = 24$ months

$$\sigma = 3.6$$

$$Z = \frac{T_S - T_E}{\sigma}$$

$$Z = \frac{24 - 24}{3.6} = 0$$

From table probability = 50%

(b) $Z = \frac{30 - 24}{3.6}$

$$Z = 1.67$$

From table probability = 95.2%

30. Ans: 65.76 & 58.25 weeks

Sol:

a) $T_E = 60$ weeks

$$\sigma^2 = 20.25$$

$$P(\%) = 90\%$$

$$\Rightarrow Z = 1.28$$

$$\begin{aligned}\text{Standard deviation } (\sigma) &= \sqrt{\text{variance}} \\ &= \sqrt{20.25} \\ \sigma &= 4.5\end{aligned}$$

$$1.28 = \frac{T_s - T_E}{4.5}$$

$$T_s = 65.76 \text{ weeks}$$

b) For P(%) = 35 %

From table,

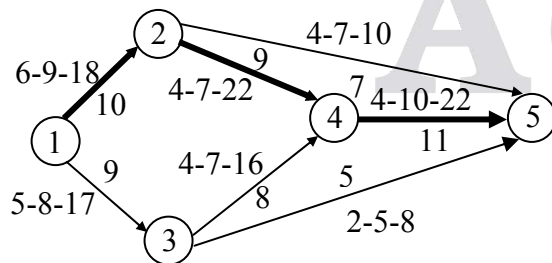
$$\begin{aligned}Z &= -0.387 \\ -0.387 &= \frac{T_s - 60}{4.5} \\ &= 58.25 \text{ weeks}\end{aligned}$$

31. Ans: 90.32%

Sol:

$$t_E = \frac{t_o + 4t_L + t_p}{6}$$

$$\sigma^2 = \left(\frac{t_p - t_o}{6} \right)^2$$



Activity	$t_o-t_L-t_p$	t_E	σ^2
1-2	6-9-18	10	4
1-3	5-8-17	9	4
2-4	4-7-22	9	9
3-4	4-7-16	8	4
2-5	4-7-10	7	1
4-5	4-10-22	11	9
3-5	2-5-8	5	1

To find critical path:

$$\begin{aligned}1-2-5 &= 10 + 7 = 17 \\ 1-2-4-5 &= 10 + 9 + 11 = 30 \\ 1-3-4-5 &= 9 + 8 + 11 = 28 \\ 1-3-5 &= 9 + 5 = 14\end{aligned}$$

Critical path = 1 - 2 - 4 - 5

Now, $T_E = 30$ days

$T_s = 36$ days

$$Z = \frac{T_s - T_E}{\sigma}$$

To calculate σ :-

$$\sigma^2 \text{ of critical path} = 4 + 9 + 9 = 22$$

$$\sigma = \sqrt{22} = 4.69$$

$$Z = \frac{36 - 30}{4.69} = 1.27 \approx 1.3$$

From the table

$$Z = 1.3 \Rightarrow \text{probability} = 90.32 \%$$

07. CPM Cost Analysis

11. Ans: (a)

Sol:

Week	Parallel Activities	Total Resource Load
9 th	A	6
11 th	A + B	$6 + 4 = 10$
13 th	A + B + D	$6 + 4 + 7 = 17$
15 th	A + B + C + D	$6 + 4 + 3 + 7 = 20$

From the above, the maximum resource load per week is 20

12. Ans: (c)

Sol: From the data given, the maximum time for the project is 11 days and minimum time is 9 days.

For 11 days, the total direct cost is:

$$800 + 1200 + 500 = 2500 \text{ units.}$$

For 10 days, the total direct cost is:

$$800 + 1350 + 500 = 2650 \text{ units.}$$

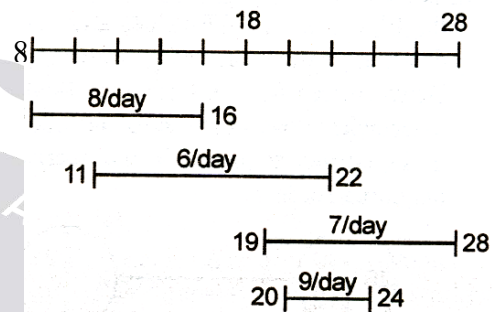
For 9 days, the total direct cost is:

$$900 + 1500 + 500 = 2900 \text{ units.}$$

∴ The feasible range of total direct cost varies from 2500 to 2900.

13. Ans: (a)

Sol:



From the given diagram, on the 21st & 22nd day three concurrent activities are there with a total resources of $6 + 7 + 9 = 22$.

Minimum resource occurs when only one activity exists. In the present case it is 6 per day.

∴ Maximum resources is 22 and minimum is 6