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# CIVIL ENGINEERING

Construction Planning and Management  
& Construction Materials

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



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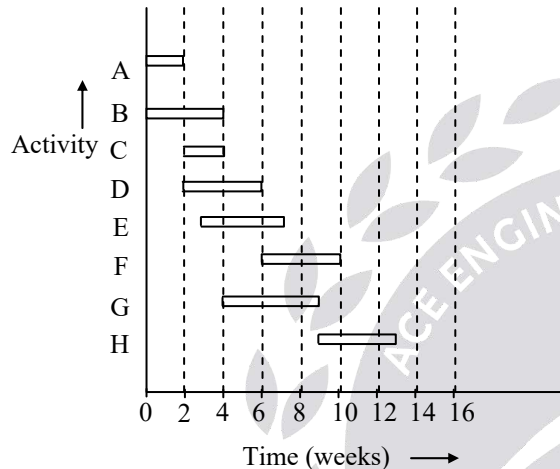
# Construction Planning & Management & Construction Materials

(Solutions for Text Book Practice Questions)

## 03. Construction Project Scheduling

07. Ans: 13 weeks

Sol:

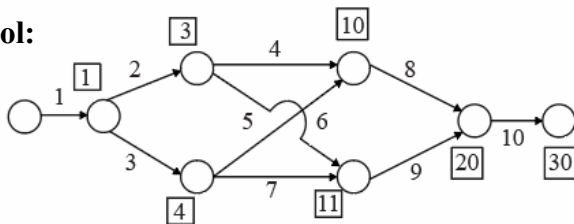


Total completion time of period = 13 weeks

## 04. CPM Network

03. Ans: (c)

Sol:



Critical Path

1 – 3 – 7 – 9 – 10

Critical path duration =  $1 + 3 + 7 + 9 + 10$   
= 30 days

04. Ans: (c)

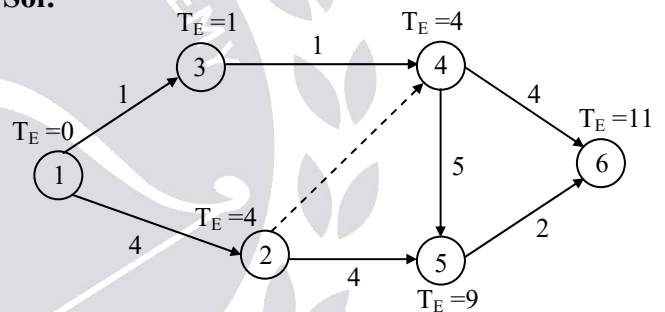
Sol:

Path	Duration
1-2-4-7-9	$6 + 4 + 8 + 10 = 28$
1-3-5-7-9	$8 + 9 + 14 + 10 = 41$
1-3-6 -8 -9	$8 + 10 + 13 + 15 = 46$

∴ Critical path is 1-3- 6 -8 - 9

06. Ans: (c)

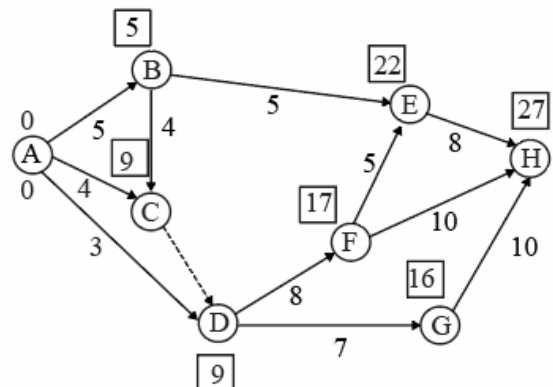
Sol:



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

08. Ans: b)

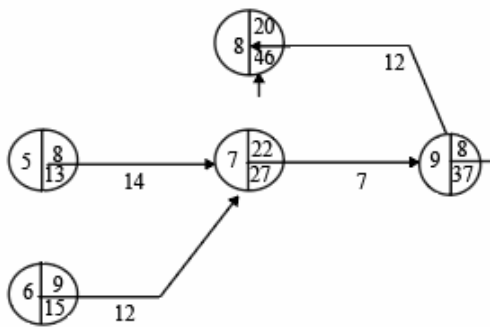
Sol:



27 days is earliest expected completion

**10. Ans : (c)**

**Sol :**



$$\text{Total float} = 15 - 9 = 6$$

$$\text{Free float} = 22 - 12 - 9 = 1$$

### 05. PERT Network

**13. Ans: (a)**

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

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

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

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

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

**19. Ans : (b)**

**Sol :**  $z = 1.647$  for 95%

$$\sigma^2 = 9 \text{ weeks} \quad \sigma = 3$$

$$T_E = 70 \text{ weeks}$$

$$T_s = ?$$

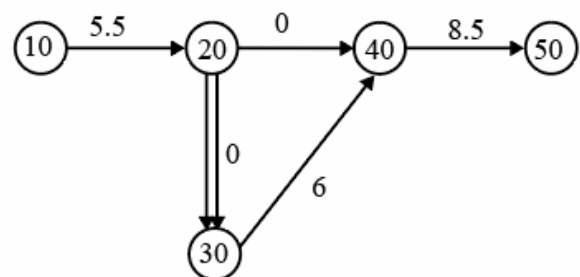
$$z = \frac{T_s - T_E}{\sigma}$$

$$T_s = \frac{T_s - 70}{3}$$

$$T_s = 70 + 4.941 = 74.94 \text{ weeks}$$

**20. Ans : (d)**

Sol :	$T_E$	$\sigma$
10 – 20	5.5	1.167
20 – 30	0	0
30 – 40	6	1
40 – 50	8.5	1.167



$$\text{Total duration} = 5.5 + 6 + 8.5$$

$$= 20 \text{ days}$$

$$\text{Standard deviation} = \sqrt{1.167^2 + 1^2 + 1.167^2}$$

$$= 1.93$$

### 06. Project Crashing & Resource Allocation

**11. Ans: (a)**

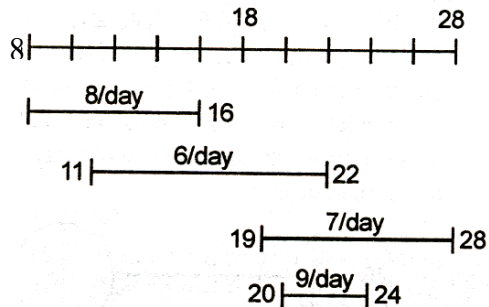
**Sol:**

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

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

**12. Ans: (a)**

**Sol:**



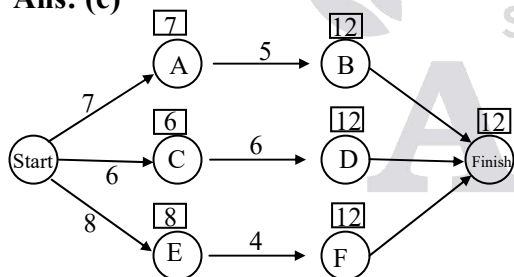
From the given diagram, on the 21<sup>st</sup> & 22<sup>nd</sup> day three concurrent activities are there with a total resources of  $6 + 7 + 9 = 22$ .

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

**19. Ans: (c)**

**Sol:**



Number of activities that need to be crashed to reduce project duration by one day is 3

**28. Ans: (c)**

**Sol:** Labour cost =  $100 \times \frac{20}{100} = 20 \text{ Cr}$

Non-productive cost =  $\frac{60}{100} \times 20 = 12 \text{ cr}$

Productive cost =  $\frac{40}{100} \times 20 = 8 \text{ cr}$

15% of wastage resulting from Non-productive time is eliminated

=  $\frac{15}{100} \times 12 = 1.8 \text{ cr}$

% of saving =  $\frac{1.8}{8} \times 100 = 22.5\%$

## 07. Engineering Economics and Depreciation

**21. Ans: (c)**

**Sol:**  $d = \frac{2}{n}$   
 $= \frac{2}{5}$

$BV_m = P(1 - d)^m$   
 $= 200000 \left(1 - \frac{2}{5}\right)^2$   
 $= 72,000$

**22. Ans: (b)**

**Sol:**  $SFF = \frac{i}{(1+i)^n - 1} = \frac{0.04}{(1+0.04)^5 - 1}$   
 $= 0.184$

**23. Ans: (c)**

$$\begin{aligned}\text{Sol: Annual depreciation} &= \frac{25000 - 1600}{8} \\ &= 2925\end{aligned}$$

$$\begin{aligned}\text{Residual book value at beginning of 6}^{\text{th}} \text{ year} \\ &= 25000 - (2925 \times 5) \\ &= 10375\end{aligned}$$

**25. Ans: (c)**

$$\begin{aligned}\text{Sol: Annual depreciation} &= \frac{10000 - 1000}{5} \\ &= 1800\end{aligned}$$

$$\begin{aligned}\text{Book value} &= 10000 - (1800 \times 2) \\ &= \text{Rs. 6400}\end{aligned}$$

## 08. Construction Contracts and Tendering

**04. 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

**05. 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.

**07. 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.

**08. 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.

**09. 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.

**11. 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.

**12. 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).

