



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 8 Examination in Engineering: August, 2022

Module Number: CE8301

Module Name: Construction Management

[Three Hours]

[Answer all questions, each question carries twelve marks]

- Q1. a) Explain the advantages of preparing a proper cash flow statement for a construction company. [2.0 Marks]
- b) A construction company prepared a cash flow statement for a development project which is planned for a 12 months construction period. Contract agreement says half of the retention will be released 6 months after project completion. Second half of the retention will be released 12 months after project completion. Following information was summarized from that cash flow statement.
- The contractor may face Rs. 250,000.00 of commutative cash outflow at the end of month 4 of the construction period.
  - The contractor can reserve Rs. 200,000.00 of commutative cash inflow at the end of month 9 of the construction period.
  - With the release of first half of retention, the contractor can reserve Rs. 500,000.00.
- Based on the above given information, answer the following with justifications.
- i The contractor plans to take a bank loan to run the project without financial deficiencies. What should be the minimum loan amount required by the contractor?
- ii What is the earliest possible time that the contractor can recover the loan? [4.0 Marks]
- c) The network diagram shown in Figure Q1 represents the activity relationships for a construction project with the resource requirements.
- i Draw the Bar chart based on all the activities starting as early as possible and indicate the available total floats. Use the provided Data Sheet Q1 when answering.
- ii Prepare labour histogram below the bar chart in Data Sheet Q1.
- iii Discuss the nature of above resource histogram and advantages/disadvantages to the contractor if he decides to use resource requirements as in your resource histogram. [6.0 Marks]
- Q2 a) Explain the advantages of using time-cost optimization methods during planning stage and construction stage. [2.0 Marks]
- b) Table Q2 includes the planned time and cost for each activity in a construction project with possible crashing information. Figure Q2 illustrates the corresponding network diagram. Carry out the crashing procedure using compression logic for

two compressions only. Hence suggest the best total project cost and the optimum project duration among the three stages assuming an indirect cost of Rs. 100.00/week.

[7.0 Marks]

- c) Write down the linear programming model to find the corresponding cost if it is necessary to finish the project within 29 weeks.

[3.0 Marks]

Q3. Assume that you were awarded an assignment from National Water Supply & Drainage Board (NWS&DB) to plan a pipe laying project. You decided to plan this project by dividing the total pipe length to 20 sections. Each section consists of five main activities as shown in Table Q3, together with necessary man hours and available gang sizes. Due to the repetitive nature of work, Line of Balance (LOB) technique was selected as the planning technique.

- a) Carry out the necessary calculations in tabular form and plot a line of balance (LOB) schedule for information shown in Table Q3 (use a graph sheet provided). In your plot, clearly indicate the expected total project duration.

[6.0 Marks]

- b) Assume that until day 70, you worked according to your plan without any disturbances. NWS&DB suddenly requires to complete the project within another twenty (20) working days.

- i What are the activities that have to be accelerated to fulfill the NWS&DB requirement?
- ii Estimate the additional labour requirement for each of those activities.
- iii Mark the required changes in the same LOB diagram.

[3.0 Marks]

- c) Explain the following terms applicable in construction planning.

- i Head Event and Tail Event
- ii Identity dummy and Logic dummy
- iii Total Float

[3.0 Marks]

- Q4. a) A private construction company was awarded a contract to renovate a housing scheme with 10 number of houses. Figure Q4 represents the progress bar chart for that project including planned and actual cost information. The project is planned to complete within 8 months. Now the project is at the end of month 5. You may assume that corresponding cost for each activity is spent equally in each month.

- i With necessary calculations, explain the progress of the project in terms of Cost and Schedule performance.
- ii Calculate the additional cost and the additional time required to complete the project based on the available data at the end of month 5.

[6.0 Marks]

- b) Table Q4 (a) represents critical ratios for few activities of a project. Referring to the definition of the critical ratio, explain the nature of progress of those activities considering given critical ratio values.

[2.0 Marks]

- c) A contractor is awarded to undertake two construction projects at the same time. However, at the moment the contractor finds he can concentrate only on one project. Cost-benefit information of the two projects is shown in Table Q4 (b). What

is the best option available to the contractor considering the "payback period" as the decision making criteria? Consider 12% discount rate.

[4.0 Marks]

Q5. a) Explain the importance of specifying the required ICTAD grade/(s) in tendering process.

[2.0 Marks]

b) List out FOUR factors considered in tender evaluation process.

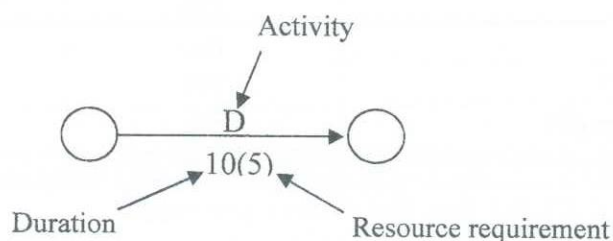
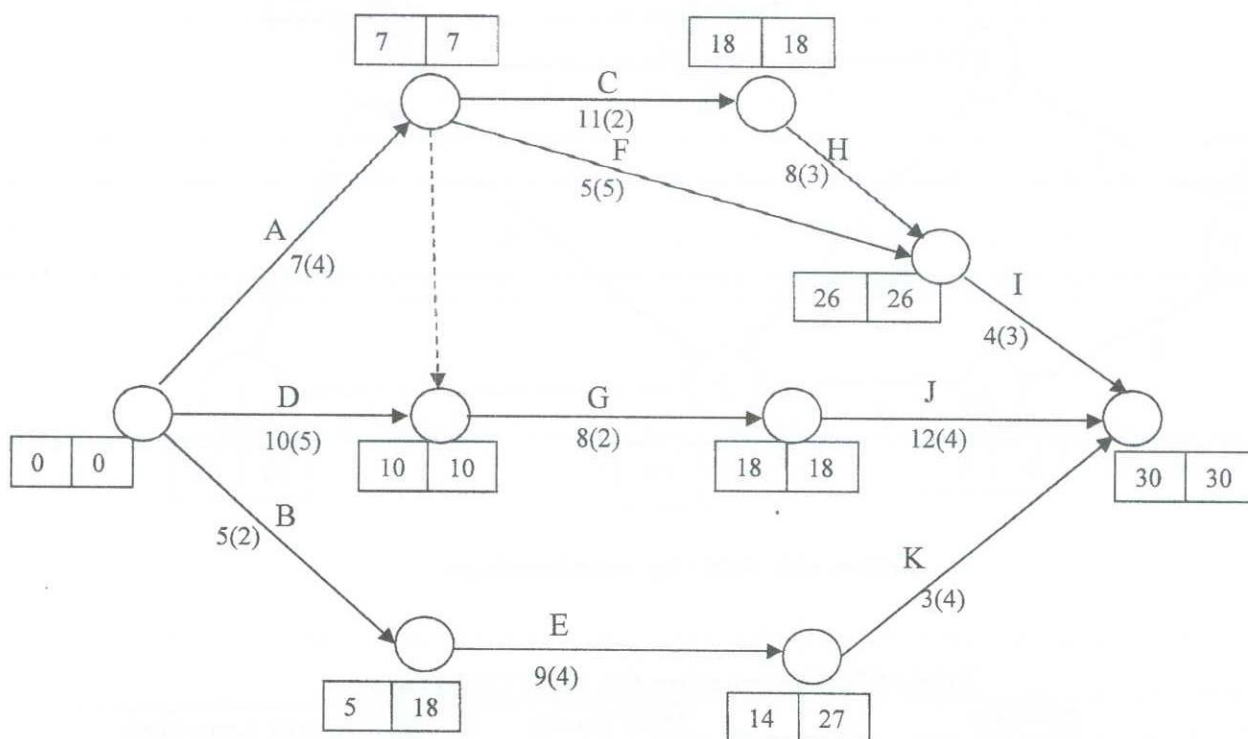
[2.0 Marks]

c) Explain FOUR different contractual agreements under concessional scheme with a suitable sketch to show the contractual relationships.

[4.0 Marks]

d) Compared to the traditional contracts, explain special features of concessional methods for construction.

[4.0 Marks]

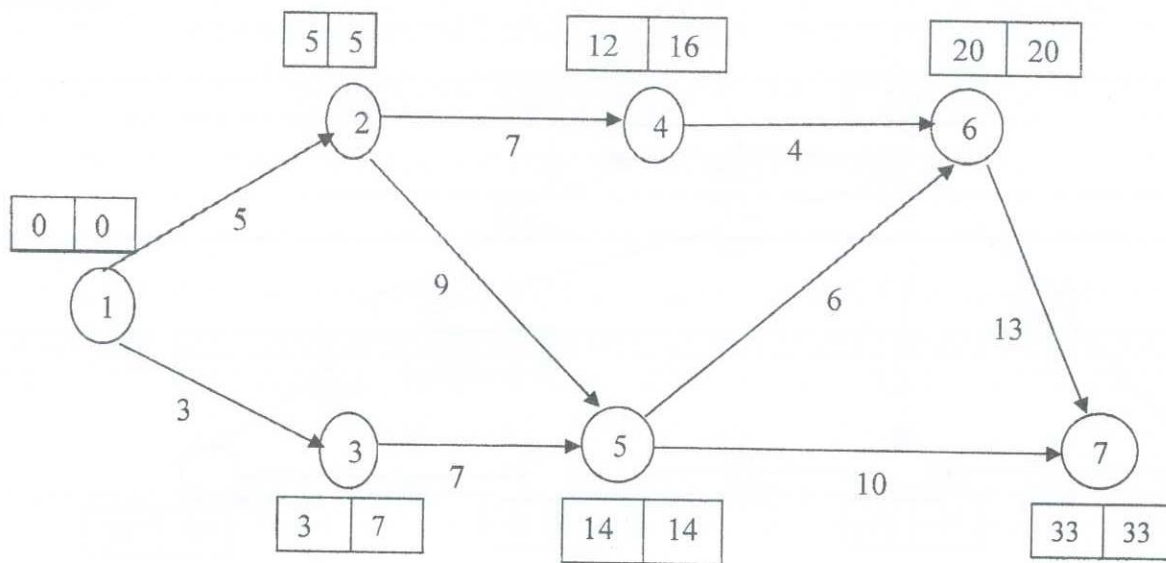


Key for network diagram

Figure Q1: Activity relationships

**Table Q2: Details of time and cost for normal and crash situations**

Activity	Time in Weeks		Cost in (Rs.)	
	Normal	Crash	Normal	Crash
1-2	5	5	500	-
1-3	3	1	450	600
2-4	7	5	420	580
2-5	9	7	1100	1400
3-5	7	4	1000	1600
4-6	4	2	700	1200
5-6	6	4	320	500
5-7	10	7	400	700
6-7	13	9	2200	3000

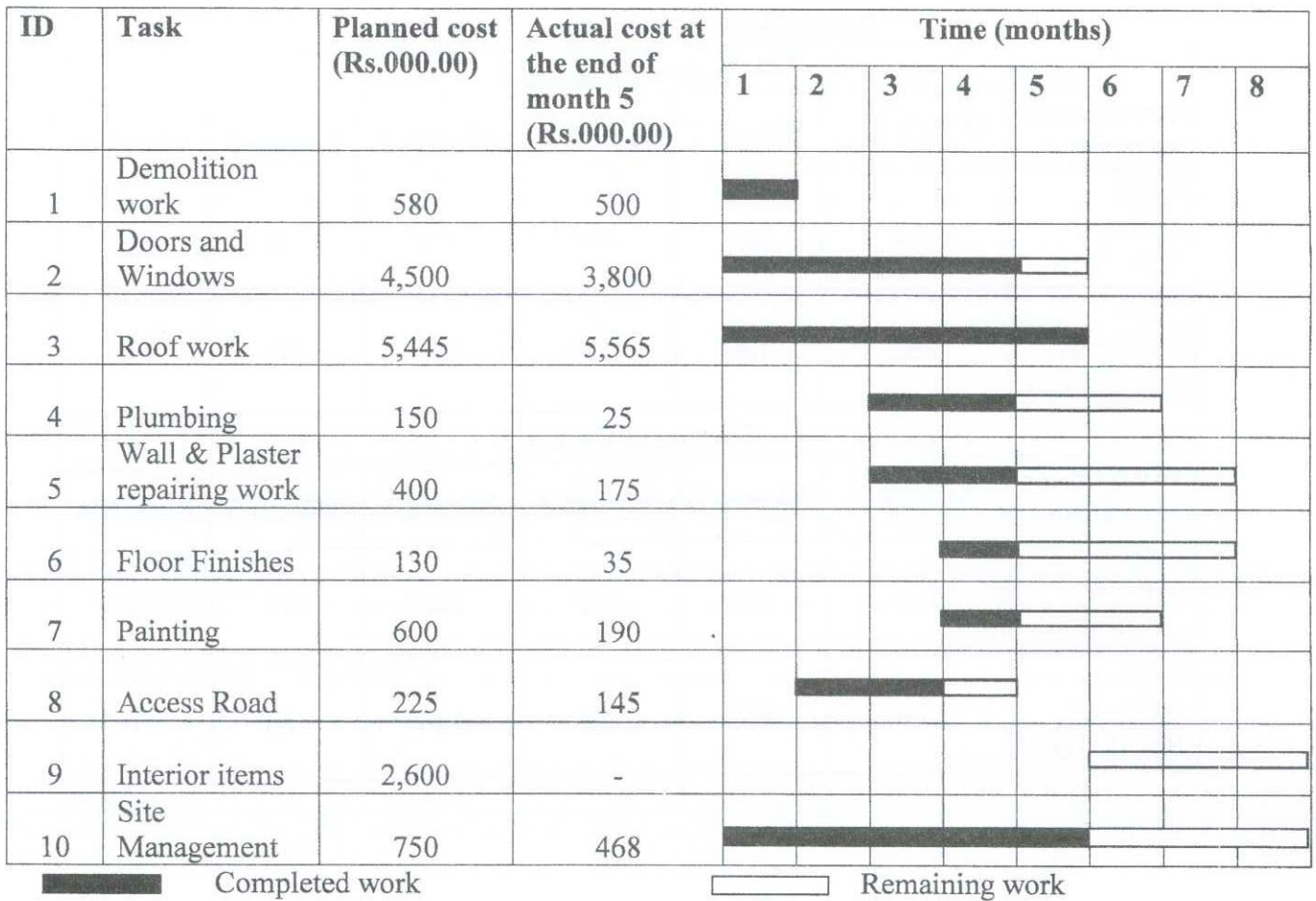


**Figure Q2: Activity relationships**

**Table Q3: Information for LOB Diagram**

Activity	Man hours	Optimum gang size
Excavation (A)	200	5
Pipe laying (B)	225	4
Back filling (C)	100	3
Soil compaction (D)	125	3
Ground preparation (E)	75	4

All activities are sequential activities. Minimum buffer time for all activities is 3 days  
 Working time is 8 hours per day and 6 days per week.  
 Production rate is 2 and half sections per week.



**Figure Q4: Progress Bar Chart**

**Table Q4 (a): Critical Ratio of Activities**

Activity	Critical Ratio
A	0.933
B	1.003
C	1.024
D	1.0
E	0.926

**Table Q4 (b): Cash Flow Information**

Proposed Project 1						
Investment cash flow	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Cash inflows (Rs. 000.00)	145	180	225	175	115	55
Cash outflows (Rs. 000.00)	250	190	200	150	90	30
Proposed Project 2						
Investment cash flow	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Cash inflows (Rs. 000.00)	175	185	200	200	115	75
Cash outflows (Rs. 000.00)	200	200	175	140	120	70

Index No:

**Data Sheet Q1**

Activity	Duration (Days)																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
A																															
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