UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: September, 2023

Module Number: CE8301 **Module Name: Construction Management**

[Three Hours]

[Answer **all questions**, each question carries twelve marks]

Q1. a) Explain the terms "Project Monitoring" and "Project Controlling".

[2.0 Marks]

b) Name two general clues for each of cost, time and quality of a construction project which indicates project controlling is necessary.

[3.0 Marks]

c) Figure Q1 represents an Earn Value Chart for a 12-month project updated at the end of month 7.

i With the necessary calculation, explain the progress of the project.

ii Based on the available data at the end of month 7, calculate the additional cost and the additional time needed to complete the project.

[7.0 Marks]

Q2 Assume that you are required to prepare a construction plan for a project owned by one of your clients. Figure Q2 represents the initial plan prepared by you together with planning information in Table Q2. However, your client needs to complete the project earlier than your initial plan. You as a planning engineer are now in the process of seeking the possibility of shortening the total project duration. As a part of this work, carry out the following.

a) As advice to your client, briefly explain the variation of project cost components with time using a suitable sketch.

[2.0 Marks]

b) Perform the crashing procedure using compression logic. You are required to do only for two compressions.

[7.0 Marks]

c) Calculate the total cost for the initial plan and the next two compressions if the indirect cost is Rs. 500.00 / day.

[3.0 Marks]

Q3.

a) Explain the level of effort that should be applied by the project team during different stages of the project life cycle.

[3.0 Marks]

b) List any four characteristics which can be used to describe the general nature of the construction industry.

[2.0 Marks]

c) Figure Q3 shows an activity network diagram where a Line of Balance (LOB) schedule is to be prepared. Table Q3 (a) gives other planning data for the LOB schedule. Buffer time is taken as two days.

i Draw the LOB diagram to represent the information available in Figure Q3 and Table Q3 (a). Use the Data Sheet provided in Page 07 to draw the LOB diagram.

ii Prepare a schedule to show the required information in Table Q3 (b).

iii If the client wants to get 15 units fully completed at the end of day 110 (remaining 10 units can be completed as the initial plan), what are the activities that have to be changed? Show the necessary changes in the same plot drawn in the above part (i).

[7.0 Marks]

Q4.

a) Figure Q4 (a) and Q4 (b) represent two resource histograms drawn based on the early start and late start of activities respectively. In your opinion, which diagram is more desirable? Justify your answer.

[4.0 Marks]

b) Table Q4 comprises the expected payments and receipts for a contractor. The following assumptions are made to prepare the cash flow forecast.

- The contractor is responsible for paying wages weekly.
- Material suppliers should be paid half of the monthly material cost at the first week of the month and the other half at the last week of the month.
- The client will pay the contractor in the preceding week after receiving the monthly bill but is subjected to 10% retention.
- Sub-contractors will be paid in the same week keeping 10% retention.
- Half retention will be released to both contractor and sub-contractors after two months of the last payment and the second half of the retention will be released at the end of the year.

i Prepare the cash flow forecast to show the above information. You may use the Data Sheet provided in Page 08 when answering this question and attach it with the answer booklet.

ii The contractor has an idea to purchase construction equipment worth Rs. 200,000.00 from the savings in his hand during this construction period. Further, he can get maximum advance payment from the project cost at the beginning project. What is the earliest possible time to purchase equipment as per his plan?

[8.0 Marks]

Q5.

a) The University of Ruhuna called tenders using CIDA/ICTAD standard bidding documents (CIDA/SBD02) for the construction of a new lecture hall building and the tenders were to be submitted on 21st September 2023 at 2:00 PM. The following cases happened during the process. Assume that you are the procurement officer and state your decisions for each of these cases with reasons.

i One contractor submitted tender documents without bid security at the time of submission but submitted it around 2:30 PM after the opening of the tenders.

ii In another contractor's bid, more than 10 items of the Bill of Quantities were not priced.

iii A third contractor submitted the bid around 1:30 PM and he submitted a letter around 1:50 PM stating that he was offering a 10% discount on the bid value.

[3.0 Marks]

b) Explain the following with respect to CIDA/ICTAD standard bidding documents.

i Late bids

ii Pre-bid meeting

iii Cost of bidding

[3.0 Marks]

c) List out FOUR factors which should be included in a tender notice.

[2.0 Marks]

d) Discuss the necessity of using concessional methods for infrastructure development in developing countries.

[4.0 Marks]

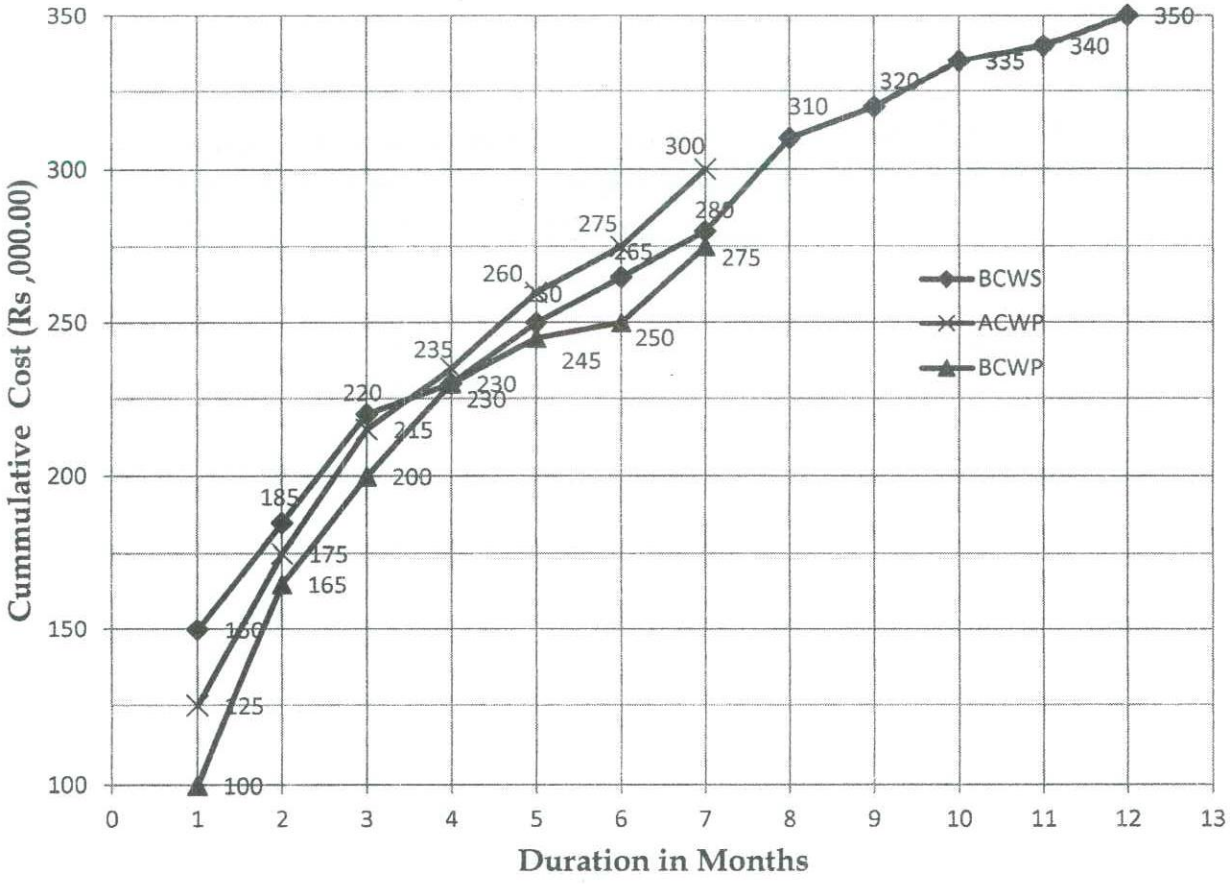


Figure Q1: Earn Value Chart

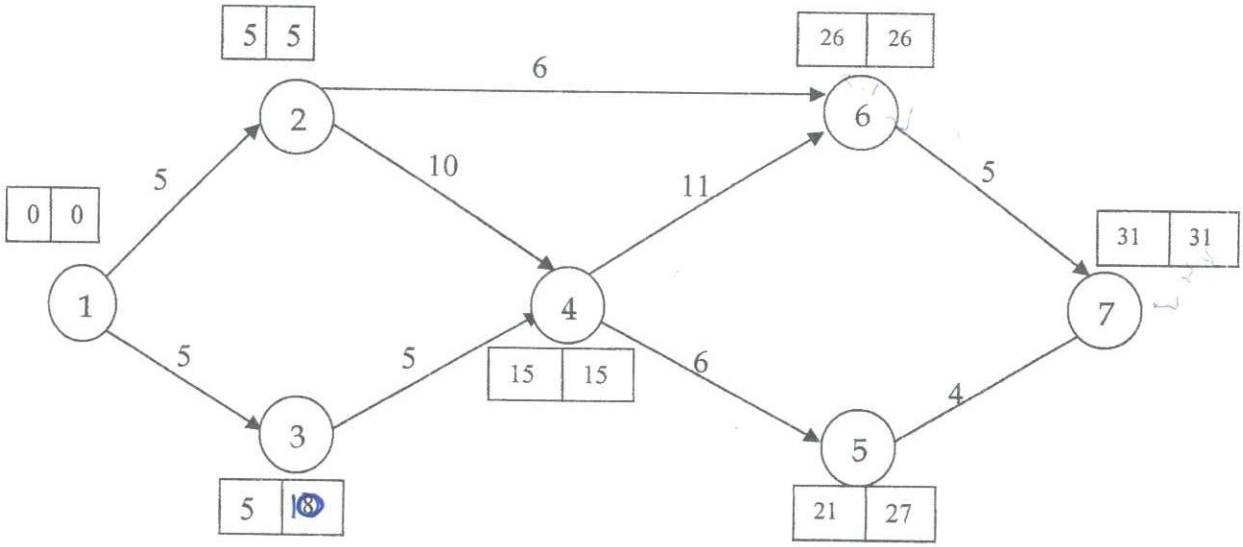


Figure Q2: Initial Activity relationship diagram

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

Activity	Time in Weeks		Cost in Rs. 000.00	
	Normal	Crash	Normal	Crash
1-2	5	3	4	6
1-3	5	1	3	5
2-4	10	5	4	7
3-4	5	2	4	6
2-6	6	2	3	5
4-6	11	5	6	9
4-5	6	4	3	6
6-7	5	1	2	4
5-7	4	1	2	5

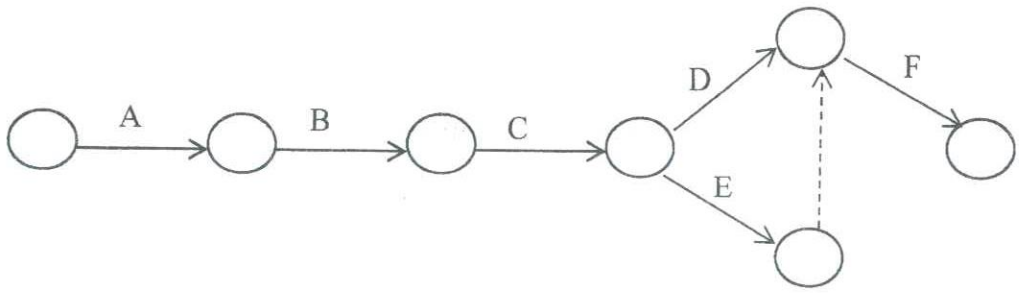


Figure Q3: Network Diagram for the LOB Schedule

Table Q3 (a): Information for the LOB Schedule

Operation	Natural rate of build	Time per operation	Elapsed time between 1st & last unit
A	2.42	5	72
B	1.92	4	91
C	1.44	5	121
D	1.60	4	109
E	2.12	4	83
F	3.85	2	46

Table Q3 (b): Schedule Prepared from LOB Schedule

Unit Number	Starting time	Finishing time
5		
10		
15		
20		
25		
30		

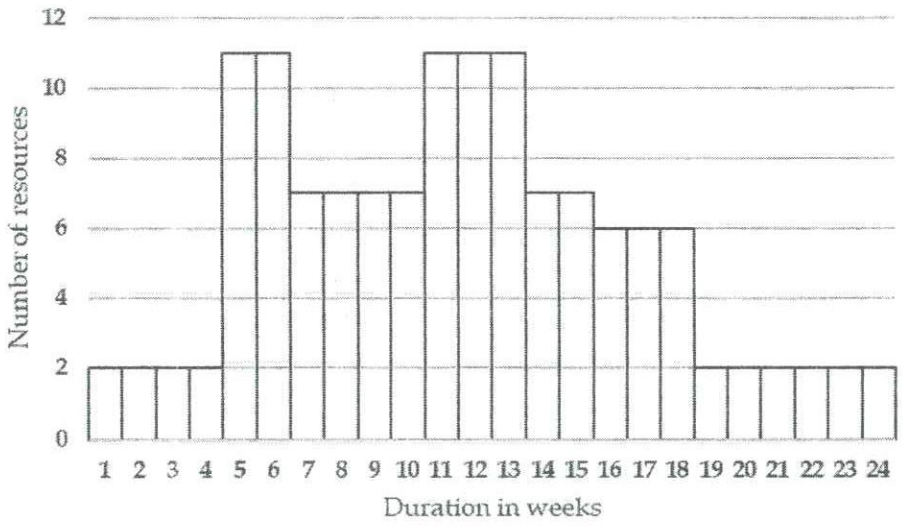


Figure Q4 (a): Resource Histogram based on Early Start of Activities

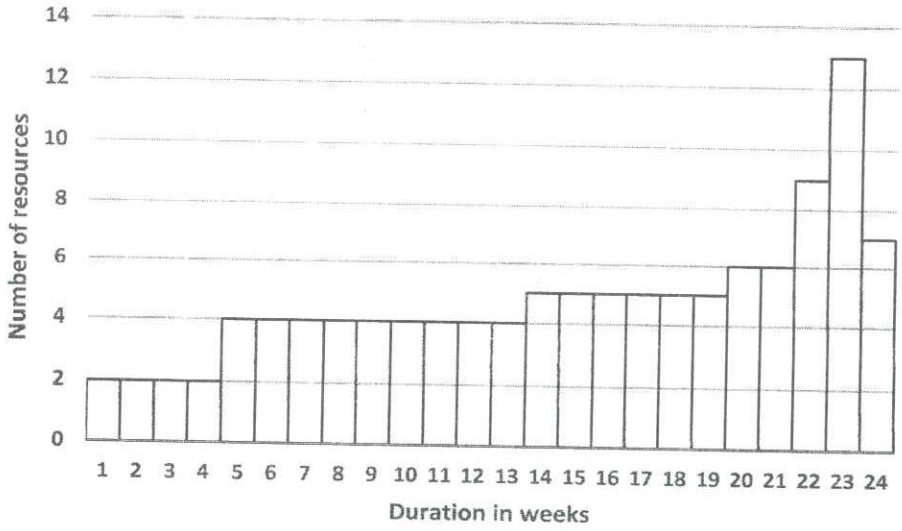


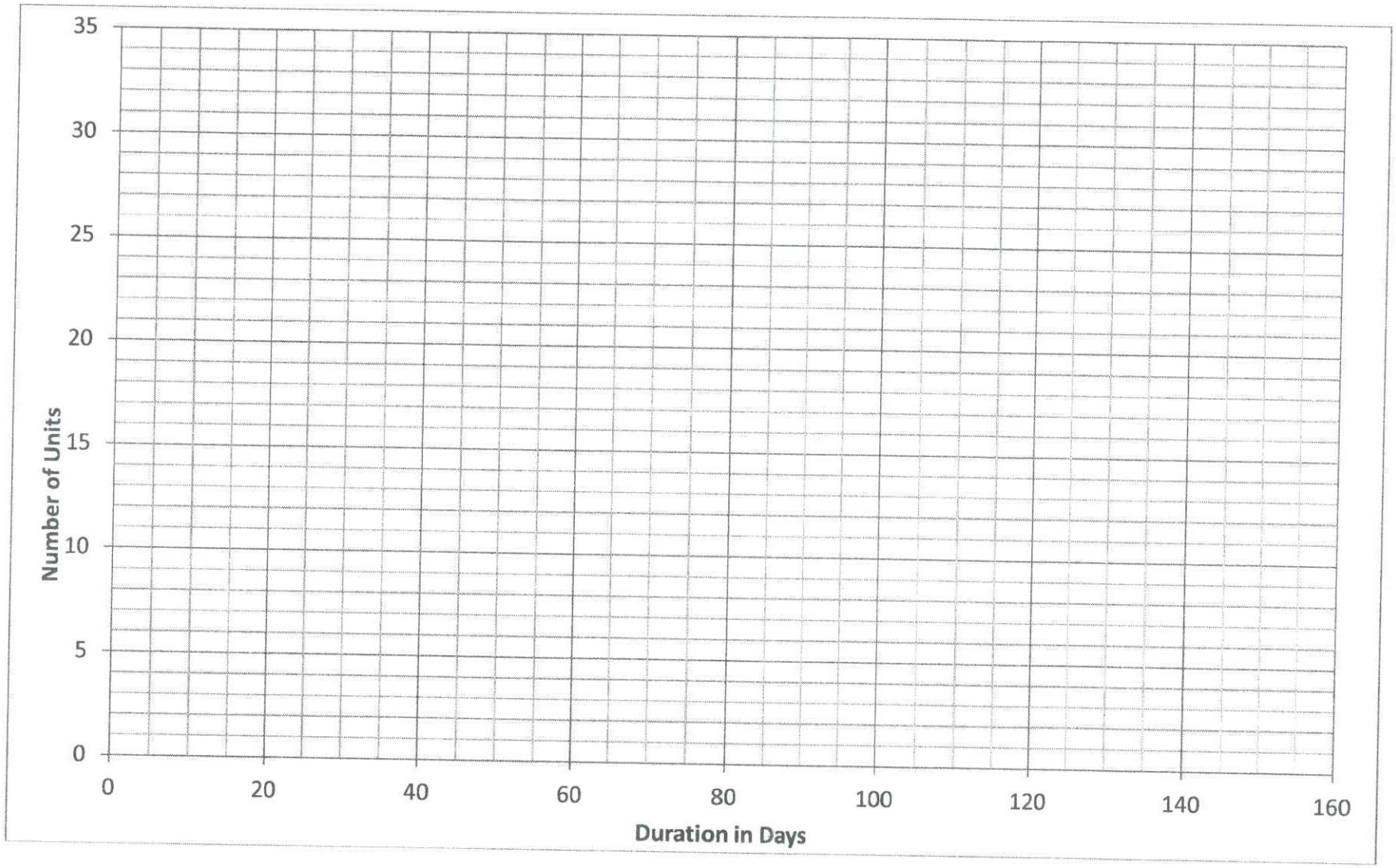
Figure Q4 (b): Resource Histogram based on Late Start of Activities

Table Q4: Contractor's Payments and Receipts

Month	Week No	Wages, plant hire and Overheads	Materials delivered	Sub Contractors accounts received	Total prime cost and overheads	QS valuation
January	1	20,000	22,500			
	2	25,000	30,000			
	3	25,000	15,000			
	4	20,000	20,000	75,000		
	5	20,000	25,000		297,500	300,000
February	6	18,000	15,000			
	7	28,000	25,000			
	8	24,000	35,000			
	9	20,000	25,000	60,000	547,500	550,000
March	10	20,000	50,000			
	11	20,000	30,000			
	12	20,000	40,000			
	13	20,000	30,000	_	777,500	775,000
April	14	15,500	25,000			
	15	23,500	25,000			
	16	15,000	25,000			
	17	12,000	25,000	50,000	993,500	1,000,000
May	18	12,000	25,000			
	19	13,000	10,000			
	20	10,000	25,000			
	21	15,000	25,000	_	1,128,500	**1,150,000**

Data Sheet to Prepare Line of Balance Diagram

Index No:



Data Sheet to Prepare Contractor's Cash Flow

Month	Week No	Wages, plant hire and Overheads	Materials	Sub Contractors	Total	Accounts received	Cumulative cash flow
January	1						
	2						
	3						
	4						
	5						
February	6						
	7						
	8						
	9						
March	10						
	11						
	12						
	13						
April	14						
	15						
	16						
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May	18						
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