



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: December 2025 (C-18)

Module Number: CE8301

Module Name: Construction Management

[Three Hours]

[Answer all questions, each question carries twelve marks]

Q1

- a) Draw and explain the Project Management Triangle. Describe how increasing or reducing one element impacts the other two in a construction project using an example (You can explain taking only one element of the Project Management Triangle). [3.0 Marks]
- b) "Project effort is not constant throughout the project life cycle." Using a suitable sketch, discuss how the level of effort varies during the formulation, mobilization, and construction stages of a construction project. [3.0 Marks]
- c) "Although bar charts are simple and widely used in construction scheduling, they have several limitations." Explain three limitations of using bar charts in construction project planning. [3.0 Marks]
- d) In the construction field, the usual practice for preparing resource histograms is based on the prepared construction schedule, after which resource allocation can be done. Answer the following questions considering the resource allocation.
- i Is it always possible to provide the required resources?
 - ii Is it always necessary to provide the required resources?
 - iii Is it practical to provide resources as indicated by a normal histogram?
- [3.0 Marks]

Q2

- a) Explain the overall project control process considering the following factors;
- i Identification of the need for project control
 - ii Resources for project control
- [4.0 Marks]
- b) A construction project consists of five major activities. The scheduled and actual information is shown in Table Q2. The project's total duration is 8 months. Project monitoring information was recorded at the end of the 4th month of the project.
- i Explain whether the project experiences a cost overrun.
 - ii Is there any schedule delay in the project?
 - iii Calculate the additional cost and the additional time at project completion based on the available data at the end of month 4.
- [8.0 Marks]

Q3

- a) Table Q3 represents the planned time and cost for various project activities, including possible crashing information. Draw the network diagram using arrow methods for normal activity durations, compute the total project duration and identify the critical path. [4.0 Marks]
- b) For the above network diagram, you are required to shorten the project duration by exactly 2 weeks at a minimum total extra cost. You are allowed to perform one crashing attempt only (i.e., change activity durations once, possibly crashing several activities simultaneously in that attempt). Determine which activity(ies) to crash and by how many weeks. [4.0 Marks]
- c) Compute the net project cost change after crashing (use Rs. 850/week as the indirect cost). State whether the crashing is economically justified. [4.0 Marks]

Q4.

- a) Table Q4 provides information to prepare a Line of Balance (LOB) diagram for a construction project which consists of the activities shown in Figure Q4. If the project is to construct 20 number of identical units, carry out the following:
- i Draw the LOB diagram to show the information in Table Q4 and Figure Q4.
 - ii After preparation of the LOB diagram, the client asked for options for reducing the total project duration to 180 days. Discuss how to accommodate the client's requirement.
- [6.0 Marks]
- b) Describe the following in reference to the Standard Bidding Document for Procurement of Works (ICTAD/SBD/01):
- i Purpose of bid security and the basis of calculating the amount of bid security
 - ii Pre-bid meeting and its purpose
 - iii Purpose of performance security and its validity period
- [6.0 Marks]

Q5.

- a) Explain why knowledge of cash flow management is important for construction planners in achieving successful project scheduling and completion. [3.0 Marks]
- b) Table Q5 comprises the expected payments and receipts for a contractor. Prepare a cash flow forecast considering the following factors i to v. You may use the data sheet provided on Page 05 when answering and attach with the answer booklet.
- i The contractor is responsible for paying wages weekly.
 - ii At the beginning of each month, Material suppliers should be paid Rs. 50,000.00 and the remaining cost of material of the particular month will be paid at the end of each month.
 - iii Client will pay the main contractor in the same week, keeping 10% retention.
 - iv Subcontractors will also be paid in the same week, keeping 10% retention.
 - v Half retention will be released to both contractor and subcontractors after two months of the last payment and the second half of the retention will be released at the end of the year.
- [6.0 Marks]

- c) Discuss the financial situation of the project based on the above cash flow statement with respect to the most critical time, the best timing for investing/taking a new project, etc.

[3.0 Marks]

Table Q2: Planned and Actual Work of a Construction Project

Activity	Budgeted Cost (LKR million)	Planned % Complete expected by Month 4	Actual % Complete by Month 4	Actual Cost by Month 4 (LKR million)
A	5.0	100%	100%	5.5
B	8.0	80%	70%	6.4
C	10.0	50%	40%	5.0
D	12.0	40%	30%	4.2
E	15.0	25%	20%	3.0

Table Q3: Details of time and cost for normal and crash situations

Activity	Predecessor	Time in Weeks		Cost in Rs.	
		Normal	Crash	Normal	Crash
A	-	4	2	4,000	5,200
B	A	6	3	6,000	7,800
C	A	5	2	4,500	6,000
D	B	7	4	7,000	9,100
E	C	3	1	3,000	3,900
F	C	4	2	3,200	4,400
G	D, E	5	3	5,000	6,500
H	F	6	4	5,400	7,200
I	G, H	2	1	1,500	2,000

Table Q4: Information for LOB Diagram

Operation	Man hours	Theoretical gang size	Man per activity	Actual gang size	Natural rate of build	Time per operation	Elapsed time between 1 st & last unit
A	350	7.29	7	7	0.96	7	119
B	325	6.77	4	8	1.18	11	97
C	400	8.33	8	8	0.96	7	119
D	250	5.21	5	5	0.96	7	119
E	375	7.81	3	6	0.77	16	149
F	275	5.73	4	4	0.70	9	164

Working hours = 8 hours per day
Working days = 6 days per week
Buffer time = 2 days
Rate of production = 1 unit per week

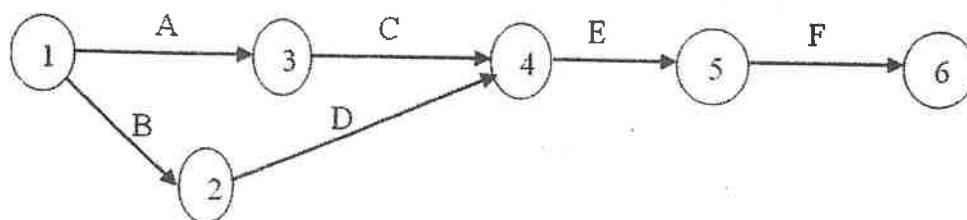


Figure Q4: Network Diagram for LOB Preparation

Table Q5: Contractor's Payments and Receipts

Month	Week No	Wages, plant hire and Overheads (Rs.)	Materials delivered (Rs.)	Sub Contractors accounts received (Rs.)	Total prime cost and overheads (Rs.)	QS valuation (Rs.)
January	1	15,000	22,500	50,000	230,500	240,000
	2	15,000	30,000			
	3	15,000	13,000			
	4	15,000	20,000			
	5	15,000	20,000			
February	6	20,000	35,000	55,500	496,500	500,000
	7	25,000	25,000			
	8	25,000	35,000			
	9	15,500	30,000			
March	10	20,000	35,000	60,000	771,500	775,000
	11	20,000	25,000			
	12	20,000	40,000			
	13	20,000	35,000			
April	14	15,500	20,000	35,500	952,000	1,000,000
	15	23,500	20,000			
	16	15,000	20,000			
	17	11,000	20,000			
May	18	12,000	25,000	25,000	1,077,000	1,150,000
	19	13,000	10,000			
	20	10,000	15,000			
	21	15,000	-			

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						
	17						
May	18						
	19						
	20						
	21						
	22						
June							
July							
August							
December							