



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 7 Examination in Engineering: August 2018

Module Number: CE7301

Module Name: Construction Management

[Three Hours]

[Answer all questions, each question carries twelve marks]

- Q1. a) Explain the three variances related to earn value analysis. [3.0 Marks]
- b) Explain how can earn value analysis be used to track performance of a project's schedule and cost. [3.0 Marks]
- c) Assume that you are the manager of a project to build a small housing scheme. You are expected to build two houses per month for the entire project duration of 12 months. Each house is estimated to cost Rs1,000,000. It is the beginning of month 10 now and, you have already built 20 houses. Your Cost Performance Index (CPI) is 0.9091.
- Briefly explain the project performance in terms of cost and schedule.
 - What is the actual cost of the project right now?
 - If the cost variance experienced so far in the project will continue, how much more money will it take to complete the project? [6.0 Marks]
- Q2 a) When might a firm choose to crash a project? What factors must be considered in making this decision? [2.0 Marks]
- b) Explain what are some of the indirect costs of crashing? [2.0 Marks]
- c) Figure Q2-1 shows the activity network diagram for a small project. Determine the project duration and the critical path of this network diagram. Each activity duration is given in days. [2.0 Marks]
- d) Table Q2-1 shows the planned time and cost(\$) for different activities in the network stated in c), with possible crashing information.
- Find the crash cost per day for each activity.
 - Which activities should be crashed to meet a 10-day deadline with a minimum cost? Determine the new project cost.
 - Determine the duration and the total project cost, if a fully crashed network is used. [4.5 Marks]
- e) What is meant by "fast tracking" of a project? List one advantage and one disadvantage associated with fast tracking? [1.5 Marks]

- Q3. a) Young, growing companies are “cash sponges”. Explain this phrase. [2.0 Marks]
- b) List three type of data required to calculate cash flows for a project. [1.5 Marks]
- c) What are three types of information that can be obtained from an accurately developed cash flow diagram? [1.5 Marks]
- d) Consider a project which requires an initial investment of Rs1,000,000. This project is expected to generate revenues as shown in Table Q3-1 for the first, second, third and fourth years. Assume the annual discount rate of 6%. Considering the data available in Table Q3-1,
 i. draw the cash flow diagram;
 ii. calculate the Net Present Value (NPV) of the project;
 iii. calculate the discounted payback period (DPP) of the project; and
 iv. identify a relationship between NPV and DPP. [5.0 Marks]
- e) “Feasibility study is a management-oriented activity”. Explain this relating to a construction project. [2.0 Marks]
- Q4. a) Explain how can the Line of Balance (LOB) method be used to plan the construction work of a project with repetitive operations. [1.5 Marks]
- b) Why is it important to find a balanced schedule where all the operations are in parallel (where possible) and the construction time is the minimum practical time? [1.5 Marks]
- c) Develop a LOB diagram for a repetitive project that consists of 20 units. The target output rate for this project is 3 units per week. A typical working week includes five 8-hour days. The construction of a single unit consists of the five sequential operations as shown in Table Q4-1. Assume a buffer time of 5 days. Supporting details are available in Table Q4-2. [6.0 Marks]
- d) List three types of information that can be obtained from the LOB diagram in c) to schedule and control the project. [3.0 Marks]
- Q5. a) Why is it important for the employer to examine whether a bid is substantially responsive to the requirements of the bidding documents? [3.0 Marks]
- b) Describe the role of “the Engineer” in projects with ICTAD/CIDA SBD conditions of contracts. [2.0 Marks]
- c) List any three types of stakeholders involved in a concession type of contract and identify each of the stakeholder’s role. [3.0 Marks]
- d) Why do some organizations consider procurement “outsourcing” over the “in-source” procurement option? [2.0 Marks]

- e) Explain the statement "Officials shall refrain from receiving any personal gain from any procurement action" mentioned under the instructions to bidders in SBD.

[2.0 Marks]

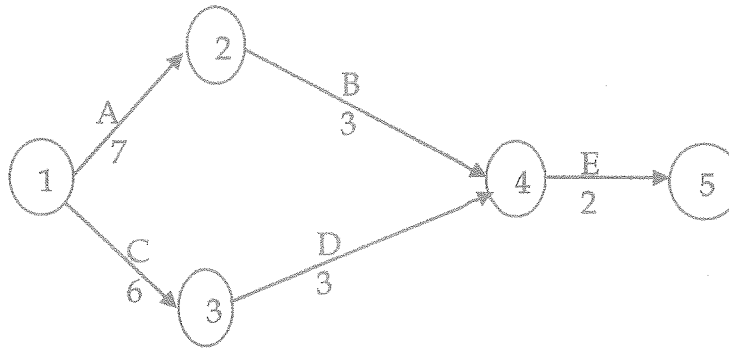


Figure Q2-1 Network Diagram of a Project

Table Q2-1 Details of Time and Cost for Normal and Crash Situations

Activity	Time in (Days)		Cost in (\$.)	
	Normal	Crash*	Normal	Crash
A	7	4	500	800
B	3	2	200	350
C	6	4	500	900
D	3	1	200	500
E	2	1	300	550

*Partial crashing allowed.

Table Q3-1 Cash Flow Details of a Project

Year	Cash Flow Rs 000s
0	-1000
1	+300
2	+400
3	+400
4	+400

Table Q4-1 Project Operation Details

Operation	Man-hours per Unit	Men per Gang
A	110	3
B	320	8
C*	365	9
D	35	2
E	210	5

*In operation C, the rate of output should not be lower than the target rate.

Table Q4-2 Supporting Details to Develop a LOB Diagram

C1	Activity Description
C2	The estimated man-hours for each activity (M)
C3	Theoretical number of men required to maintain the output (G) $= \frac{\text{rate of production} \times \text{man hours per activity}}{\text{No of working hours per week}}$
C4	The optimum gang size decided by experience and historical data (Q)
C5	Actual number of men (g) This is chosen as a number which is a multiple of the optimum gang size nearest to the theoretical number of men (G) If $g > G$ rate of output is more than the target rate If $g < G$ rate of output is less than the target rate
C6	The actual rate of output (u) $= \frac{\text{Actual no of men} \times \text{target rate}}{\text{Theoretical no of men}}$
C7*	Time taken for one activity in days $= \frac{\text{Man hours per activity}}{\text{(number of men in one team} \times \text{No of hours in a working day)}}$
C8*	The time in days from start of the first item to the start of the last item $= \frac{\text{(No of items - 1)} \times \text{No of working days/week}}{\text{(Actual rate of build)}}$

*Round up the duration (~~C1~~) and elapsed time (~~C2~~) to the upper value.

C1

C2