



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 7 Examination in Engineering: July 2016

Module Number: CE7301

Module Name: Construction Management

[Three Hours]

[Answer all questions, each question carries twelve marks]

- Q1. a) What are the indicators that can be used to identify that the project monitoring is needed for a project at a particular time? [2.0 Marks]
- b) Explain how you can resolve resource related problems when controlling a project. [4.0 Marks]
- c) Figure Q1 represents an Earn Value Chart for a project updated at the end of month 6.
- i With necessary calculation, explain the progress of the project.
- ii Based on the available data at the end of month 6, calculate the additional cost and the additional time needed to complete the project. [6.0 Marks]
- Q2. a) Table Q2 represents the planned time and cost for different activities of a project with possible crashing information. Figure Q2 represents the corresponding network diagram. Carry out the crashing procedure using compression logic for three compressions. Hence suggest the best total project cost and the optimum project duration among the four stages assuming an indirect cost of Rs. 850.00/week [6.0 Marks]
- b) If you are required to use all the possible crashing time at once without converting critical path/s to non-critical path/s and most economically, what is the minimum possible total project duration and corresponding extra cost? [3.0 Marks]
- c) Write down the linear programming model to find the corresponding cost if it is necessary to finish the project within 38 weeks. [3.0 Marks]

- Q3. a) Figure Q3 is a prepared Line of Balance (LOB) diagram for a construction project having 20 number of identical housing units. Table Q3 gives the data used for the LOB diagram. Each unit has mainly six sequential activities. After preparing the LOB diagram, client is not satisfied with the proposed completion date. Then the contractor proposed several options as in below (i) to (iii). Calculate the total project duration for each option. Assume that activity duration changes are negligible with these changes.
- i Completion rate of activity D can be doubled by adding individual labours to the particular labour gang.
 - ii Available labour gangs can be doubled for all the activities which enable to work in parallel units.
 - iii Common completion rate with 1.92 can be given for all the activities by adding individual labours to all the labour gangs.
- [6.0 Marks]
- b) Once prepared a resource aggregation charts for a project, how it can be used as a decision making tool?
- [2.0 Marks]
- c) Explain the use of resource leveling and resource smoothing.
- [2.0 Marks]
- d) When there are resource limitations or/and constraints, how you can decide the priority order to allocate resource for activities?
- [2.0 Marks]
- Q4. a) What are the information needed by the contractor to prepare a meaningful cash flow statement?
- [2.0 Marks]
- b) What are the information that can be used by the client through a cash flow statement prepared by the contractor?
- [2.0 Marks]
- c) Discuss the advantages and disadvantages of cash flow diagram over the tabular format cash flow statement.
- [2.0 Marks]
- d) Table Q4 comprises the expected payments and receipts for a contractor. Prepare a cash flow forecasting considering following factors. You may use the data sheet provided in Page 08 when answering and attach with the answer booklet.
- i Contractor is responsible for paying wages weekly.
 - ii Material suppliers will be paid at the end of each month. But contractor has to keep Rs. 50,000.00 deposit to the material supplier at the beginning of the construction and the deposit will be re-funded at the beginning of the last month of the construction.
 - iii Client will pay to the contractor in the same month keeping 10% retention.
 - iv Sub-contractors will be paid with one month delay keeping 10% retention.
 - v Half retention will be released to both contractor and sub-contractors after two months of the last payment and second half of the retention will be released at the end of the year.
 - v Contractor is expecting to receive a payment of Rs. 75,000.00 at the end of April from another project and he wish to use it in this project.
- [6.0 Marks]

Q5.

- a) Explain the importance of using concessional method to construct an infrastructure for a developing country.

[3.0 Marks]

- b) An employer invited for bids from eligible bidders to construct a building. Eligibility requirements were, bidders should have registered under ICTAD and grade should be C4 and above for building. Bid closing time was 10.00 am on 12th July, 2016 and bid opening time was 10.30 am on same day. Table Q5 shows the information related to bid submission. Name the bid-opening order with necessary special attention and who will be marked as substantially non-responsive bidders. Give reason for your answer.

[3.0 Marks]

- c) Explain the followings in relation with ICTAD standard bidding document.

- i Purpose of bid-security, its validity and value.
- ii Occasions where a bid-security may be forfeited
- ii Purpose of performance bond and its value.

[6.0 Marks]

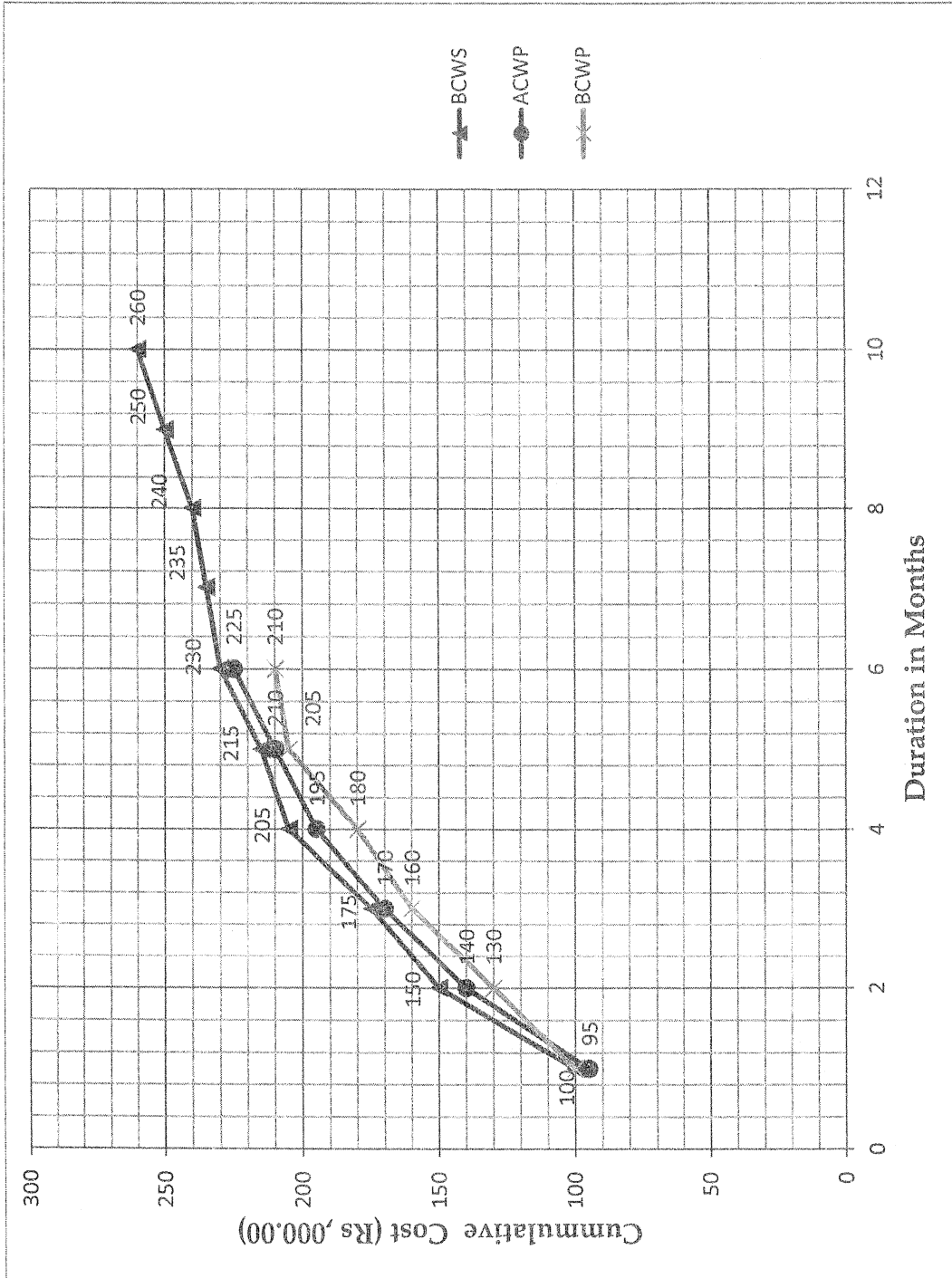


Figure Q1: Earn Value Chart

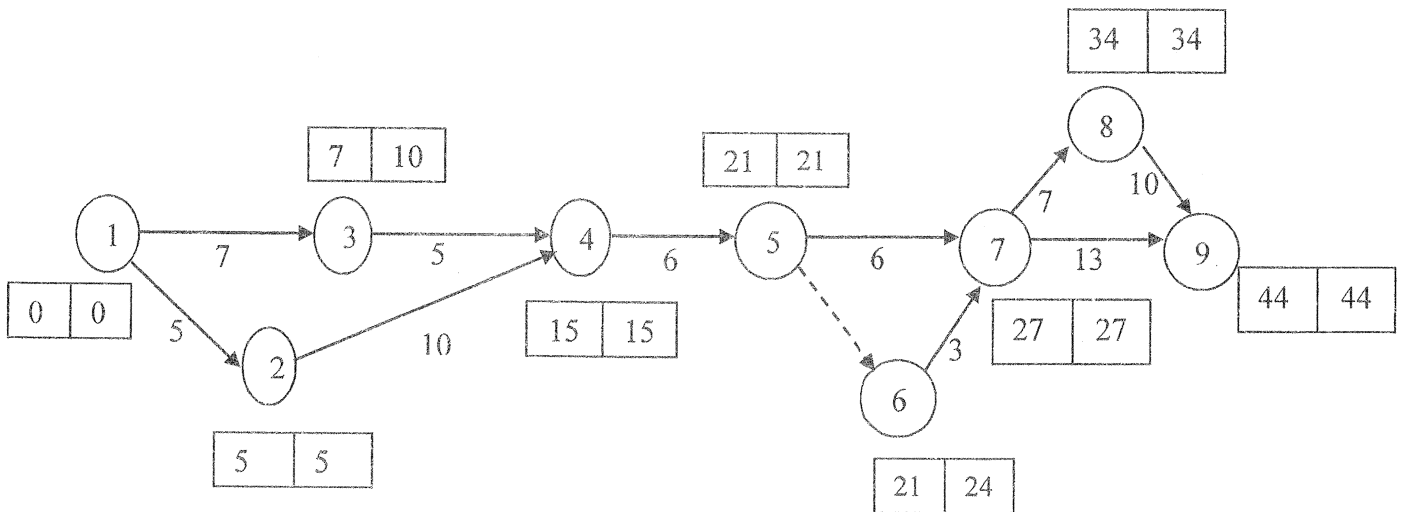


Figure Q2: Activity relationships

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	4	4,000	6,000
1-3	7	5	3,000	5,000
2-4	10	8	4,000	7,000
3-4	5	2	4,000	6,700
4-5	6	4	3,000	5,000
5-7	6	5	6,000	9,000
6-7	3	2	3,000	6,000
7-8	7	4	2,000	4,400
7-9	13	10	2,000	5,000
8-9	10	7	5,000	8,000

Table Q3: 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	300	6.25	9	9	1.44	5	80
B	350	7.29	8	8	1.10	6	104
C	300	6.25	8	8	1.28	5	90
D	200	4.17	6	6	1.44	5	80
E	250	5.21	7	7	1.34	5	85
F	100	2.08	4	4	1.92	4	60

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

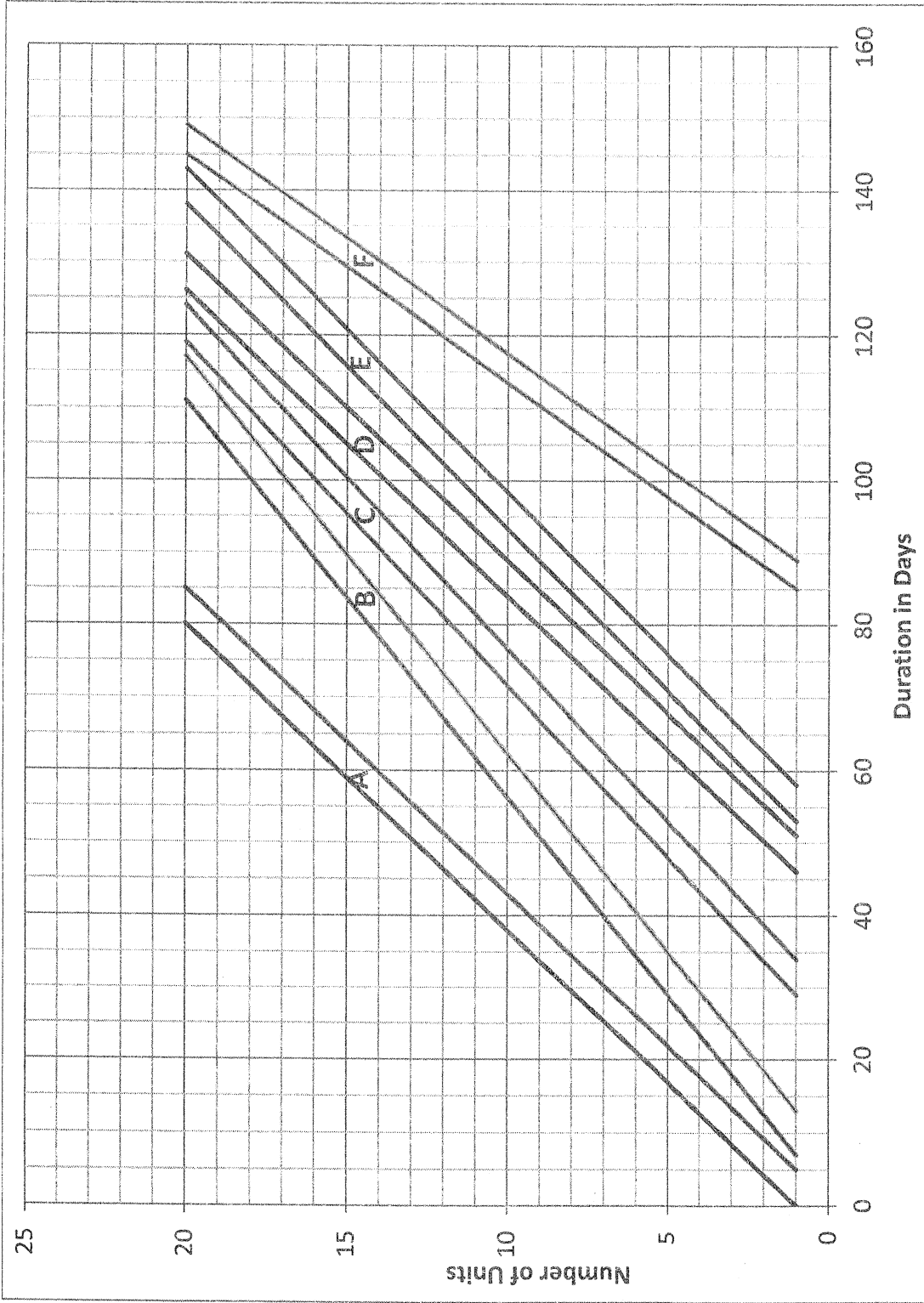


Figure Q3: LOB Diagram

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	3,000	5,500			
	2	3,500	5,000			
	3	3,000	4,000			
	4	2,500	4,000			
	5	2,500	4,000		37,000	35,000
February	6	3,000	3,000			
	7	3,000	5,000			
	8	2,000	6,000			
	9	3,000	6,000	15,000	83,000	85,000
March	10	5,000	8,000			
	11	5,000	2,500			
	12	7,500	18,000			
	13	4,000	10,000	25,000	168,000	165,000
April	14	3,500	8,000			
	15	3,500	10,000			
	16	4,000	10,000			
	17	5,000	7,000	10,000	229,000	230,000
May	18	4,000	10,000			
	19	3,500	15,000			
	20	3,500	8,000			
	21	2,500	10,000			
	22	3,000	5,000	12,500	306,000	310,000

Table Q5: Bid-Submission Information

Bidder's Name	ICTAD Grade/Specialty	Bid submitted Time/Date	Remarks
A	C4/Building	9.35 am on 11 th July, 2016	-
B	C2/Building	14.30 pm 11 th July, 2016	Modification were given at 9.30 am on 12 th July, 2016
C	C2/Building	10.05 am on 12 th July, 2016	-
D	C2/Building	10.50 am on 8 th July, 2016	Withdrawal has been sent at 11.00 on 11 th July, 2016
E	C1/Building	15.30 pm on 4 th July, 2016	-
F	Building	11.30 am on 5 th July, 2016	-
G	C3/Building	10.30 am on 4 th July, 2016	No bid-security
H	C4/Building	9.45 am on 12 th July, 2016	-

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							