UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 7 Examination in Engineering: July 2017

Module Number: CE7301 **Module Name: Construction Management**

[Three Hours]

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

Q1. a) Explain the overall project control process considering following factors;

i. Identification of need of project control
ii. Resources for project control
iii. Mechanisms and elements of project control

[2.0 Marks]

b) Figure Q1(a) is a Bar Chart which is used for project monitoring purpose. Table Q1(a) gives the actual progress of the project at the end of day 20. Update the Bar Chart as per the progress. Use the same Figure [Figure Q1 (a)] for the answer.

[3.0 Marks]

c) Figure Q1(b) shows a typical Earn Value Chart. Explain the terms used there and how this earn value chart can be used for project monitoring purpose.

[4.5 Marks]

d) Table Q1(b) represents the cost and progress information of a project. Calculate Critical Ratios for each activity and discuss the nature of progress for each activity with respect to Critical Ratios.

[2.5 Marks]

Q2 a) Explain two situations where the time cost optimization can be used in construction projects.

[2.0 Marks]

b) Table Q2 represents the planned time and cost for different activities of a project with possible crashing information. Draw the network diagram using arrow methods for the normal activity durations.

[3.0 Marks]

c) If you are required to crash the project using maximum possible crash times of activities without affecting the available critical path/s and most economically by a single crashing attempt, what is the minimum possible total project duration and corresponding extra cost?
Indirect cost of Rs. 850.00/week can be used.

[4.0 Marks]

d) Write down the linear programming model to find the corresponding cost, if it is necessary to finish the project within 32 weeks.

[3.0 Marks]

Q3. a) Table Q3 (a) provides information to prepare a Line of Balance (LOB) diagram for a construction project which consists of the activities shown in Figure Q3. 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 Q3 (a) and Figure Q3.

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

[6.0 Marks]

b) After preparation of the LOB diagram, client asked options for reducing the total project duration. Contractor' view is, only for the activity F; labours can be increased in any numbers. Considering all other requirements and limitations, what is the lowest project duration with the highest possible addition of labour for activity F?

[2.0 Marks]

c) What is the additional labour requirement for activity F to achieve above lowest project duration?

[2.0 Marks]

d) Explain two limitations of using LOB diagram:

i. As a planning technique and

ii. As a scheduling technique.

[2.0 Marks]

Q4. a) In the construction field, resource histograms is prepared based on the prepared construction schedule and then resource allocation can be done. Discuss the following aspects 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]

b) Discuss the importance of having a "**desirable pattern**" in resource histograms

[2.0 Marks]

c) 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.

- Contractor is responsible for paying wages weekly.
- At the beginning of each month, Material suppliers should be paid Rs. 50,000.00 and remaining cost of material of the particular month will be paid at the end of each month.
- Client will pay the contractor in the same week keeping 10% retention.
- Sub-contractors will also 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 second half of the retention will be released at the end of the year.

[5.0 Marks]

d) Based on the information available in your answer above, answer for followings
   i What is the best time, if the contractor wants to invest for some other purpose?
   Ii If the contractor can get Rs. 200,000.00 advance payment, what will reflect from the cash flow forecasting?

[2.0 Marks]

Q5.

a) Describe the importance of implementing following aspects in civil engineering contracts:
   i Bid Security
   ii Performance Bond guarantee

[2.0 Marks]

b) "Awarding a civil engineering contract to a contractor is a legal binding between the client and the contractor". Explain this statement in relation to the fundamental elements of contract.

[5.0 Marks]

c) Explain the reaction of a tender evaluation committee in following situations:
   i Late Bids
   ii "Original" and "Copy"
   iii "Withdrawal"

[3.0 Marks]

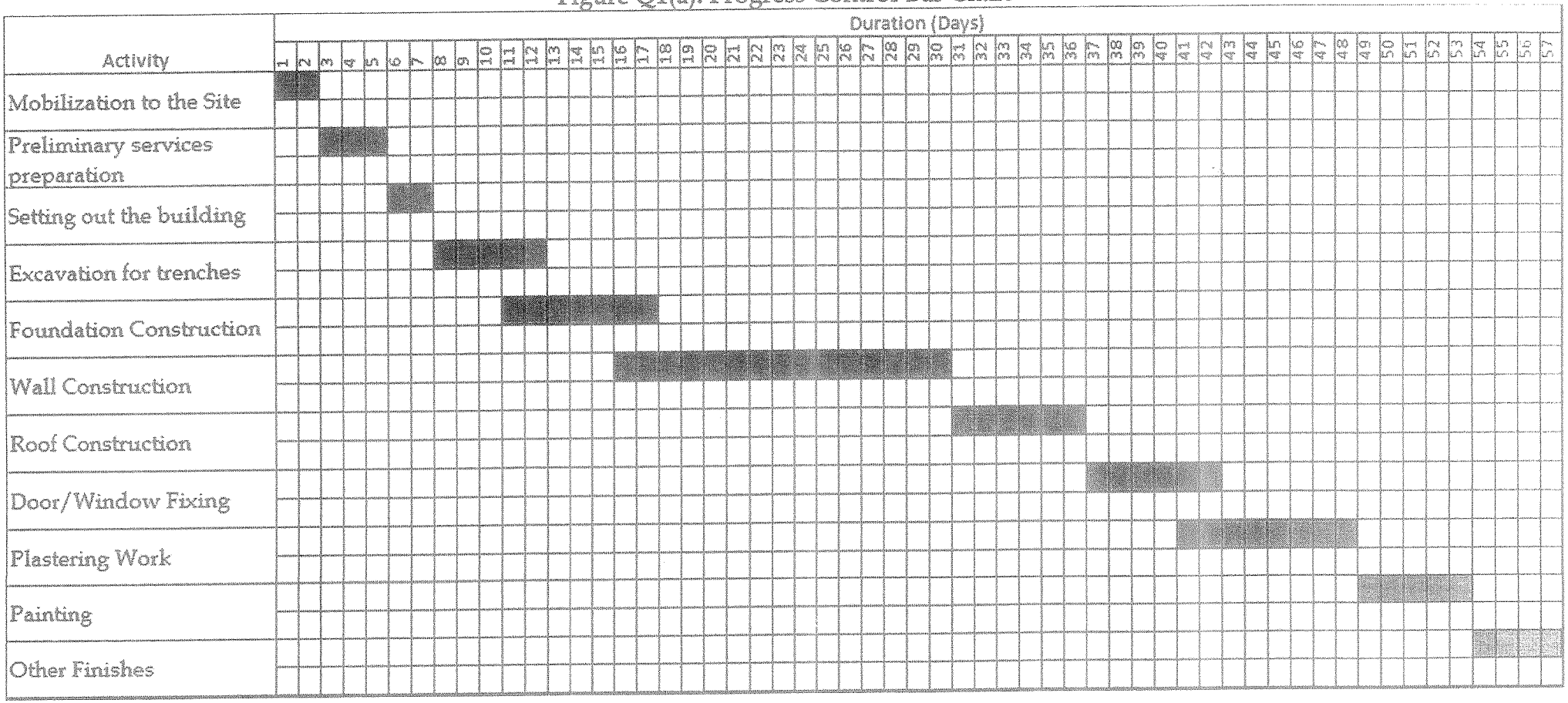
d) Compared to the traditional contracts, explain special features of concessional methods for construction.

[2.0 Marks]

Table Q1(a): Work Progress

Activity	Days Used	Work Progress (%)
Mobilization to the Site	2	100
Preliminary services preparation	3	100
Setting out the building	2	100
Excavation for trenches	6	100
Foundation Construction	4	50
Wall Construction	2	25
Roof Construction	-	-
Door/Window Fixing	-	-
Plastering Work	-	-
Painting	-	-
Other Finishes	-	-

Figure Q1(a): Progress Control Bar Chart



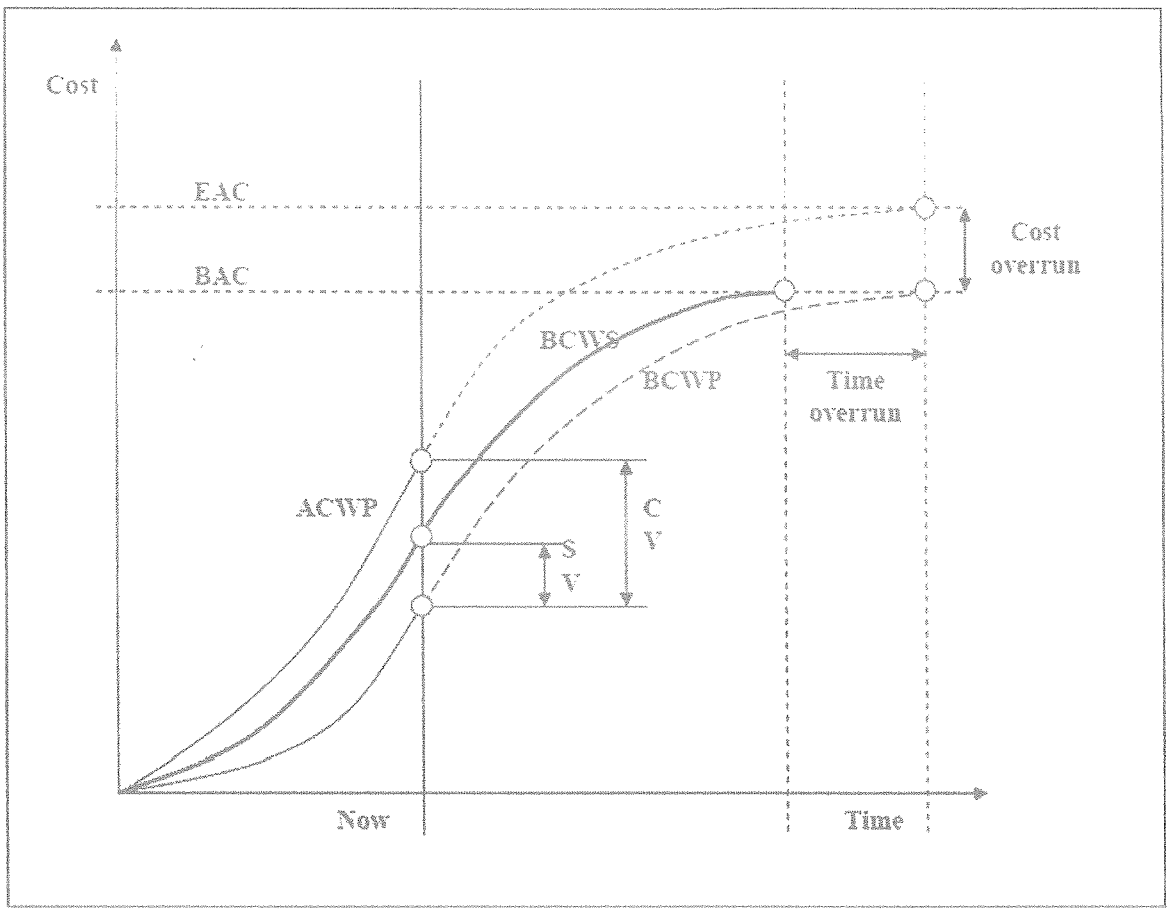


Figure Q1 (b): Typical Earn Value Chart

Table Q1(b): Project Cost and Progress Information

Activity	Actual progress (%)	Schedule progress (%)	Actual cost (Rs. ,000.00)	Schedule cost (Rs. ,000.00)
A	80	75	200	175
B	60	62	135	140
C	50	50	125	128
D	40	45	75	70
E	25	30	45	50

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
2-3	7	5	3,000	5,000
2-4	10	8	4,000	7,000
2-5	5	2	4,000	6,700
3-5	6	4	3.000	4,500
4-5	0	0	0	0
5-6	3	2	3,000	6,000
6-7	7	4	2,000	4,400
6-8	13	10	2,000	5,000
7-8	10	7	5,000	8,000

Table Q3 (a): 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 1st & last unit
A	325	6.77	7	7	1.03	6	110
B	400	8.33	4	8	0.96	13	119
C	375	7.81	8	8	1.02	6	112
D	225	4.69	5	5	1.07	6	107
E	150	3.13	3	6	1.92	6	60
F	200	4.17	4	4	0.96	6	119

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

Table Q3 (b): Schedule Prepared from LOB Schedule

Unit Number	Starting time	Finishing time
5		
10		
15		
20		

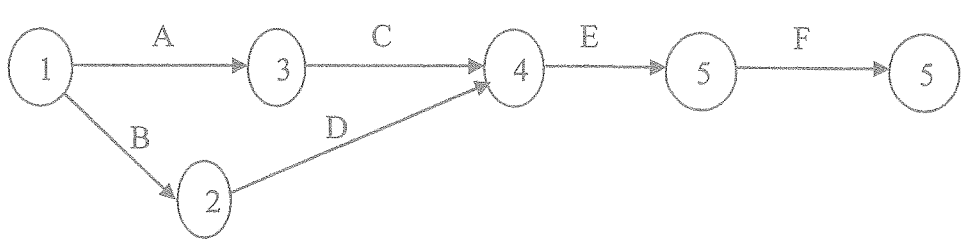


Figure Q3: Network Diagram

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	15,000	22,500			
	2	15,000	30,000			
	3	15,000	13,000	50,000		
	4	15,000	20,000			
	5	15,000	20,000		230,500	240,000
February	6	20,000	35,000			
	7	25,000	25,000	55,500		
	8	25,000	35,000			
	9	15,500	30,000		496,500	500,000
March	10	20,000	35,000			
	11	20,000	25,000	60,000		
	12	20,000	40,000			
	13	20,000	35,000		771,500	775,000
April	14	15,500	20,000			
	15	23,500	20,000	35,500		
	16	15,000	20,000			
	17	11,000	20,000		952,000	1,000,000
May	18	12,000	25,000			
	19	13,000	10,000			
	20	10,000	15,000			
	21	15,000	-	25,000	1,077,000	**1,150,000**

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							