

UNIVERSITY OF BOLTON
SCHOOL OF ENGINEERING
MSc CIVIL ENGINEERING
MSc CONSTRUCTION PROJECT MANAGEMENT
SEMESTER ONE EXAMINATION 2021/2022
PROJECT MANAGEMENT
MODULE NO: CPM7002

Date: Monday 10th January 2022

Time: 14:00 – 17:00

INSTRUCTIONS TO CANDIDATES:

This exam paper contains TWO sections: section 'A' and section 'B'

Section A contains TWO questions: you must answer these TWO questions. They are worth a total of 50 marks.

Section B contains THREE questions: you should answer any TWO questions from these three questions. Each of these questions is worth 25 marks.

Marks for parts of questions are shown in brackets.

This assessment carries 100 marks.

All working must be shown.

CANDIDATES REQUIRE:

Formula Sheets (attached following questions).

Section A – Compulsory Questions (Answer Both Questions in this section)

Question One

- (a) PRINCE2 is generic in managing projects; explain this term by discussing the four elements of Principles, Themes, Processes and Project Environment in PRINCE2 structure. **(5 marks)**
- (b) PRINCE2 manages projects by monitoring the performance of six different variables. Discuss and justify these variables. **(5 marks)**
- (c) Appraise the roles and responsibilities of a project manager, and critically discuss the skills and attributes required to be an effective project manager. **(5 marks)**
- (d) Critically discuss the five key stages through which groups or teams pass (Tuckman's Model) and relate that to the nature of the construction industry. **(5 marks)**

Total 20 marks

Question Two

Table Q2 contains 13 construction activities and their duration (in **days**) in a project. The table also shows the immediate predecessor for each activity (s) as well as the (**FS**) lagging time of some activities (in **days**) from a specific predecessor.

Complete the following tasks:

- (a) Draw a network diagram for the above activities using a Precedence Diagram. **(8 marks)**
- (b) Carry out forward and backward passes to determine earliest & latest start times and earliest & latest finish times for each activity, the network critical path and the project duration. **(8 marks)**

Question 2 continues over the page....

PLEASE TURN THE PAGE....

School of Engineering
 MSc Civil Engineering & Construction Project Management
 Semester One Examination 2021//2022
 Project Management
 Module No: CPM7002

Question 2 continued....

(c) Calculate the Total Float (TF), Free Float (FF) and Total Time Available (TTA) for all non-critical activities.

(8 marks)

(d) The construction manager discovered that duration of activity G should be 10 days instead of 6 days, and that of activity K should be 9 days instead of 4 days. Explain how this would affect the network critical path and the total duration of the project.

(6 marks)

Total 30 marks

Activity	Duration	Preceded By	Lag
A	5	–	
B	6	A	
C	4	A	3
D	5	A	
E	9	B	
F	7	B	2
		C	
G	6	C	
H	8	C	
		D	4
I	3	D	
J	7	E, G	
		F	2
K	4	F, G, H	
L	1	H	3
		I	
M	2	K, L	

Table Q2

PLEASE TURN THE PAGE....

Section B – Answer any two questions

Question Three

The activities involved in the construction of a road project are given in **Table Q3.1** together with their estimated durations, logical sequence and cost. Each of the activities will be done using a separate gang. At the start of day 13 from start of the project, the actual work status report is shown in **Table Q3.2**.

For this project, complete the following tasks:

- (a) Draw the project network using Precedence Diagram and determine the project critical path and duration. **(5 marks)**
- (b) Produce the project Gantt Chart **(5 marks)**
- (c) Using the Earned Value Management (EVM) technique, check whether the project is on track cost wise and schedule wise. **(15 marks)**

Activity	Predecessor	Duration (Day)	Cost/Day (£/Day)	Total Cost (£)
A	–	6	400	2400
B	–	2	450	900
C	A	8	550	4400
D	A, B	5	350	1750
E	B	3	500	1500
F	D, E	6	400	2400
G	C, D	5	500	2500
H	F, G	2	475	950

project is on track cost wise and schedule wise. **(15 marks)**

Total 25 marks

Table Q3.1

Activity	Actual % Complete	Actual Cost (£)
A	100	2500
B	100	1250

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester One Examination 2021//2022
Project Management
Module No: CPM7002

C	35	2250
D	75	1625
E	100	1688
F	0	0
G	0	0
H	0	0

Table Q3.2

PLEASE TURN THE PAGE....

Question Four

- (a) Critically evaluate the process of Project Risk Management and how each stage of risk analysis and risk response could be conducted including the techniques/tools used in each stage.

(13 marks)

- (b) Critically discuss the six main steps of value engineering, and the main tasks and outcomes of each stage.

(12 marks)

Total 25 marks

Question Five

A construction company has been awarded a contract and in the stage of putting an operational plan for the construction phase. The project manager (PM) has determined that 9 tasks would be needed to construct the project. Using the **PERT** three-estimate approach, the PM has obtained estimates for how long these tasks will take as presented in **Table Q5**. **Table Q5** also shows the precedence relationships for these tasks as envisaged by the PM.

Activity	Preceded by	Estimated Times (Days)		
		<i>a</i> (Optimistic)	<i>m</i> (Most likely)	<i>b</i> (Pessimistic)
A		4	5	6
B	A	10	12	14
C	A	7	9	16
D	B	14	17	22
E	B, C	10	15	30

School of Engineering
 MSc Civil Engineering & Construction Project Management
 Semester One Examination 2021//2022
 Project Management
 Module No: CPM7002

F	C	4	7	13
G	D	12	20	40
H	D, E	10	12	15
I	F, H	8	9	10

Table Q5

- (a) Perform the Critical Path Method (CPM) calculations based on the most likely durations and determine the critical path and project duration.
(5 marks)

Question 5 continues over the page....

PLEASE TURN THE PAGE....

Question Five continued

- (b) Now apply the Project Evaluation and Review Technique (PERT) and calculate the mean project duration and its standard deviation, if the network keeps the same critical path as in (a).
(10 marks)
- (c) What is the duration of the project with at least a 90% confidence level?
(5 marks)
- (d) Compare and discuss the differences between the CPM and PERT project durations found in (a) and (b).
(5 marks)

Total 25 marks

END OF QUESTIONS

Formula sheets follow over the page....

PLEASE TURN THE PAGE.....

Useful Formulae

PERT Equations

$$t_e = \frac{a + 4m + b}{6} \quad ;$$

$$v_e = \left(\frac{b - a}{6} \right)^2$$

$$T = \sum_{i=1}^n t_e^i \quad ;$$

$$S = \sqrt{\sum_{i=1}^n v_e^i}$$

$$Z = \frac{d - T}{S} \quad ;$$

$$P(d \leq T) = 1 - P(T > d)$$

where,

- t_e = expected mean duration of activity
- v_e = variance of activity duration
- a = optimistic estimate for activity duration
- m = most likely estimate for activity duration
- b = pessimistic estimate for activity duration, ($a < m < b$)
- T = project mean duration
- S = standard deviation of project duration
- d = project required deadline duration
- n = number of activities along the critical path
- $P(d \leq T)$ = probability of project required duration less than or equal project expected duration
- Z = standard normal random variable

PLEASE TURN THE PAGE....

EVM Terms and Equations

EVM Term		Definition	Formula
Planned Value*	PV	The budgeted cost for the work scheduled.	
Earned Value*	EV	The budgeted cost for the work actually completed.	
Actual Cost*	AC	The actual cost of the work actually completed.	
Schedule Variance	SV	The measure of schedule performance on a project.	SV = EV – PV
Cost Variance	CV	The measure of cost performance on a project.	CV = EV – AC
Schedule Performance Index	SPI	The measure of progress achieved compared to progress planned.	SPI = EV / PV
Cost Performance Index	CPI	The measure of the value of work completed compared to the actual cost or progress.	CPI = EV / AC

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester One Examination 2021//2022
Project Management
Module No: CPM7002

PLEASE TURN THE PAGE....

PAST EXAMINATION PAPER

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester One Examination 2021//2022
Project Management
Module No: CPM7002

END OF PAPER

PAST EXAMINATION PAPER