

QP Code : 14069

(3 hours)

[Total Marks: 80]

- Note:
- 1) Attempt any 4 Questions
 - 2) All questions carry equal marks
 - 3) Figures to the right indicated marks
 - 4) Assume any suitable data if required

1. a) Table 1 below gives the weights of various contents in 15 concrete mixes used for construction on site.

[14]

Table 1: Data pertaining to a sample of 15 concrete mixes used for construction

Sr. No.	Cement content (X) (grams)	W/C ratio (Y)	Compressive strength (Z) (N/mm ²)
1	133	0.457	34.7
2	132	0.452	33.5
3	144	0.435	38.7
4	128	0.462	29.2
5	135	0.446	35.0
6	137	0.443	36.3
7	131	0.455	33.5
8	129	0.463	29.9
9	142	0.440	38.4
10	136	0.448	36.8
11	138	0.439	37.4
12	135	0.451	34.9
13	137	0.443	36.7
14	133	0.449	35.6
15	132	0.456	35.2

Find out the Karl-Pearsons Simple co-relation coefficient that exists between:

- (i) Cement content(X) and W/C ratio(Y)
- (ii) Cement Content(X) and Compressive strength(Z)
- (iii) W/C ratio(Y) and Compressive strength(Z)

Also check for probable error and find coefficient of determination. Comment on the physical significance of C.D obtained

1. b) Explain different types of risks associated with construction projects with practical examples and elaborate on how and which mathematical tools will enable project managers to predict and hence mitigate these risk.

[6]

2. a) Develop multiple linear regression equation for the 3 parameters of concrete given in Table 1 [8]

2. b) Decide the optimum no. of associated units for the prime mover based on the following data:

- (i) Mean cycle time of the prime mover = 2.5 minutes
- (ii) Mean haul time of the associated unit = 10 minutes
- (iii) Haul Unit capacity – 5 cu.m.
- (iv) Hourly cost of prime mover, C_P = Rs. 7000/-
- (v) Hourly cost of associated unit, C_A = Rs. 700/-

Based on conventional practise, for this work, 5 associated units were assigned. Using Griffi's waiting line model, decide whether the associated units assigned are optimum or adding unnecessary extra cost to the project. Justify your decision. [12]

3. a) Explain Poissons distribution and its use in project management, with an example. [6]

3. b) Prepare a simulation model based on Monte-Carlo simulation to generate a range of random numbers, for the mean for the actual cost of 20 projects of similar nature as given below. Select suitable range for each. Run the simulation. (refer Table 2 for costs of previous projects & Table 3 for random numbers) [14]

Table 2: Cost of previous projects similar in nature

Project No.	Project cost (in Lakh Rs.)	Project No.	Project cost (in Lakh Rs.)
1	13.87	11	11.21
2	33.51	12	58.11
3	12.90	13	61.27
4	19.80	14	31.48
5	13.18	15	8.91
6	58.99	16	31.01
7	43.36	17	91.81
8	101.90	18	51.22
9	31.89	19	81.23
10	29.21	20	12.28

Table 3: Random Number Table

20	17	42	01	72	33	94	55	89	65	58	60
74	49	04	27	56	49	11	63	77	79	90	31
94	70	49	49	05	74	64	00	26	07	23	00
22	15	78	49	74	37	50	94	13	90	08	14
93	29	12	20	26	22	66	98	37	53	82	62
45	04	77	48	87	77	66	91	42	98	17	26
44	91	99	08	72	87	33	58	12	08	91	12
18	23	91	95	97	98	52	49	40	37	21	46
04	50	65	37	99	57	74	98	93	99	78	30
32	70	17	05	79	58	50	26	54	30	01	88
03	64	59	55	85	63	49	46	61	89	33	79
62	49	00	67	28	96	19	65	13	44	78	39
61	00	95	85	86	94	64	17	47	67	87	59
89	03	90	40	10	60	18	43	97	37	68	97

4. a) Explain application of Cox Model, Nunally and Vorster-Sears models in predicting and controlling construction equipment breakdown costs with practical examples [10]

4. b) The bricks supplied to a particular construction site in Ulve come from the 4 different brick manufacturing kilns located in the vicinity. After investigation, it was observed that Kiln 1 manufactures 5000 bricks at a time, of which 10% are defective. Kiln 2 manufactures 3500 bricks of which 20% are defective. Kiln 3&4 manufacture 3000 bricks each of which 15% are defective. If, during random inspection, one Kiln is selected, and one brick is drawn at random from that kiln, what is the probability that the selected kiln is defective? [10]

5. a) A tendered is bidding for construction works, averagely 10 nos. in a year for the past 5 years. Find the probability that:

(i) He gets atleast 8 works

(ii) He gets exactly 3 works

(iii) He does not get any work

(iv) He does not get more than 2 works

(v) He gets all the works

[10]

5. b) For the construction of a shear wall, the contractor used concrete which consisted of different batches. The following compressive strengths in N/mm^2 were recorded for each batch of concrete for M30 grade (refer table 4).

Table 4: Batch no. vs Compressive strength

Batch no.	Comp. strength(N/mm^2)
1	32.5
2	31.2
3	27.3
4	34.5
5	37.5
6	27.3
7	31.2
8	31.4
9	30.3
10	35.6
11	28.7
12	33.4
13	28.7
14	33.1
15	32.8

You are the quality control in-charge from the client's side. Based on the above data and your assumed benchmark, decide whether you will accept or reject the concrete work. Also suggest some recommendations to the contractor for improving the concrete quality. [10]

6 a) Data related to performance of particular projects executed by industry experts was collected by interviewing them (refer table 5).

Table 5: Project Background Information

Sample No.	1	2	3	4
Name of the expert	Mr. A	Mr. B	Mr. C	Mr. D
Field and Experience	Project Management Consultant – 20 Years Experience	Superintendent Engineer in MES – 30 Years Experience	Project Manager – 18 Years Experience	Civil Contractor - 35 Years Experience
Nature of the project	Hospital Building	Security Wall	Shopping Complex	Residential Building
Location	Pune	Mumbai	Manama, Bahrain	New Delhi
Magnitude of project	Area = 15,000 sq. ft. Basement + 5 floors	2.8 m high 6 km. in length	99 shops 2 floors Area = 500*500 sq. m	Ground + 4 floors Floor area 17000 sq. ft

Reflecting on the overall project, experts were asked to rate how successful they feel the project had been, using a scale of 1 to 5, with 1 being very unsuccessful to 5 being very successful(refer table 6).

Table 6: Scores given by the experts with regards to performance of their respective projects

Elements	1	2	3	4
Cost	2	4	4	4
Quality	3	2	5	4
Time	2	1	3	2
Customer Satisfaction	4	3	5	4
Financial Planning	1	5	5	4

Hence Spearman's rank co-relation coefficient is desired to be determined to find out if there is any resemblance between the projects based on the given characteristics. [10]

6. b) For a particular project, it was estimated that 1 lakh cement bags would be required. The ordering cost is Rs. 1000/- per order. The unit cost of cement bag was estimated Rs. 350/- Inventory carrying cost is 20% of the average annual inventory.

During the project, it was found that only 90,000 bags were required. Also the cost of cement bags increased to Rs. 370/- The ordering cost increased by Rs. 500/-, whereas the inventory carrying cost remains as it is. Find out how much % increase or decrease in cost would be incurred due to variation. (Perform sensitivity analysis). [10]

QP Code : 14073

80 Marks

3 Hours

- Note: 1. Attempt any 4 Questions
 2. All questions carry equal (20) marks
 3. Figures to the right indicate marks
 4. Attempt sub questions in order
 5. Assume any data, if required, and state them clearly

1. a) List down the direct costs and indirect costs included on a construction project. [4]
 b) Table 1 gives the cost duration data for a small construction project.

Activity	Immediate Successor	Duration (in week)		Cost (in Rs.)	
		Normal	Crash	Normal	Crash
A	C,D	6	2	50000	65000
B	E,F	4	2	40000	50000
C	H	5	4	30000	50000
D	G	2	2	30000	30000
E	G	4	2	55000	65000
F	H	8	6	45000	60000
G	H	9	6	60000	80000
H	—	10	8	70000	100000

The indirect cost is Rs. 60,000/- per week

- i) Draw the network and find critical path. Find the normal duration and the corresponding direct, indirect costs and total project cost. [5]
 ii) Carry out stage by stage compression and find optimum duration and corresponding costs. [6]
 iii) Find all crash solution. [3]
 iv) Plot a graph of costs Vs Time. [2]

2. a) What do you mean by Project Management Consultants? Appraise their roles in construction of an mass housing scheme [10]
 b) An expressway is to be planned between two major cities in a State, Discuss the contents of pre- feasibility study for the project. [10]

3. a) Classify the various forms of organization. You are the CEO in a contracting firm, which is interested in construction of residential complexes, which form of organization would you prefer to adopt for your firm? [10]
 b) Highlight significant contributions of Fayol, Taylor, Mayo and Maslow to theories of management [10]

4. a) The following data refers to time motion study of a dumper loader operation for earth moving activity: [10]

Obs No	Time reqd fo adjustment (sec.)	Time reqd to excavate and fill bucket (sec.)	Time reqd for swing (sec.)	Time reqd for lifting, positioning (sec.)	Time reqd to fill the dumper (sec.)
1	35	50	13	26	144.3
2	14.5	27	10.5	45.5	128.7
3	18.5	42	15.5	86.5	73.4
4	17	41.5	14	59.4	124.5
5	38	20	16.5	34.6	56.7

Based on statistical analysis (measures of dispersion), determine which sub-activity is most efficiently performed and which is least consistently performed. Comment on what may be the possible reasons for the poor performance of the sub-activity. Also apply the factors to obtain standard time for the activity

4. b) For the construction of a section of the river portion of the bridge, 3 sand suppliers; viz. Falcon Sand Suppliers, Surve Sand Company and Katmale Traders, supplied sand during the construction. It was observed that, during the last 6 months, Falcon Sand Suppliers had delivered 344 brass of sand, out of which 32 brass was found to be reddish in colour and hence was not used for the intended purpose. Rate at which they supplied sand was Rs. 5700/ brass. Out of the 344 brass received, 310 brass was received as promised.

Surve Sand Company, who furnished with 300 brass during the same period, charged Rs. 5750/ brass. No defect whatsoever was found in their sand quality, however, due to lack of manpower, they could not supply 120 brass out of the 300 promised on time.

Katmale Traders, who supplied 583 brass, were the lowest price suppliers at Rs. 5675/ brass. However, 42 brass of the total supplied was too coarse than desired and 34 brass was reddish sand, which contained high amounts of salts and minerals, and was not suitable for construction. Katmale Traders were late with 27 deliveries of 2 brass each.

Select a proper rating indices for the above analysis. Which vendor would you select for your project. Justify your decision. [10]

5. Write short notes on the following: [20]

- String Diagram.
- Importance of communication and coordination between client, consultant and contractor
- Site Mobilization & Job Layout
- PRIMAVERA & MSP
- Project life cycle.

6. You are the materials manager of a very reputed construction company. On a prestigious construction project, your company requires 2 lakh cement bags annually. Cement bag cost including taxes and transportation is Rs. 375/- per bag. Ordering cost is Rs. 5,000/- per order. Inventory carrying cost is 15% of average annual inventory. Overstocking cost may be computed as follows: [20]

Duration of overstock in months	% of Basic unit price
upto 3, inclusive	2
3.1 to 6	2.5
beyond six	4.5

Under-stocking cost may be considered as 3% of the cost of the total cement bags causing the under-stocking.

The monthly consumption of cement is as follows:

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
8000	12000	16000	20000	24000	32000	26000	22000	16000	12000	8000	4000

Decide suitable order Quantity.

QP Code : 14079

(CBSGS)

(3 Hours)

Total Marks: 80

N.B 1) Answer any four questions.

2) Each main Question carries equal marks.

Q 1) Write short notes on followings (any four)

----20 Marks

- Hydra set
- Glenium 7700
- Smart materials used in construction.
- Role of superplasticisers in concrete mix.
- Materials used in nuclear structures
- Significance of Self compacting concrete

Q 2) a) Explain general engineering properties of building materials along with their acceptance criterias.

---- 10 Marks.

b) Explain "Silica fume concrete" in detail.

---- 10 Marks.

Q 3) a) Explain how fly ash can be utilized efficiently in concrete?

---- 10 Marks.

b) What do you understand by, " Air entrained concrete"?

Explain how it is prepared? Also state its application in practice.

---- 10 Marks.

Q 4) What is self compacting concrete? Explain in detail how it is prepared?

Also explain the tests conducted on fresh SCC.

---- 20 Marks.

Q 5. a) Define. "High Performance Concrete" Explain salient features of HPC.

Also explain the classification of HPC.

----- 12Marks.

b) Which chemical admixtures are used in construction practices? Explain in detail along with their purposes.

----- 08Marks.

Q 6) Explain: -

---- 20 Marks.

- Factors affecting the effectiveness of admixtures.
- SIFCON & SIMACON
- Compositions of basic building materials.
- Need of advanced construction materials in today's Constructions.

Project Risk Analysis & Mitigation tech.

CBSGS

80 Marks

3 Hours

- Note: 1. Attempt any 4 Questions
 2. All questions carry equal (20) marks
 3. Figures to the right indicate marks
 4. Assume any data, if required, and state them clearly
 5. Attempt sub questions in order

Q1.

[20M]

In an item including dewatering at contractor's cost, for a particular strata and for a particular quantity of work, following costs have occurred on 10 previous projects.

Sr. No.	Cost in Rs.
1	3,000
2	7,000
3	15,000
4	5,000
5	2,500
6	9,000
7	3,200
8	12,000
9	4,000
10	2,300

- Find mean and standard deviation.
 - Rate accepted in the tender is Rs. 3500 which includes 10% profit. Assuming normal distribution, determine the probability of completing the above activity in the tendered cost.
 - Determine cost based on 3 point cost estimate.
 - Forecast whether execution of above activity will be profitable or not and explain why.
- v) Comment on the magnitude of risk associated with the above item of work.

[TURN OVER

Q2.

- a) Explain the various mathematical tools available to deal with uncertainties in construction, based on the degree of uncertainty. [4]
- b) Explain different types of risks associated with construction projects with practical examples and elaborate on how and which mathematical tools will enable project managers to predict and hence mitigate these risks. [10]

Q3

- a) Portfolio A has a risk of 12% and a return of 16%, where as portfolio B has a risk and return both of 10%. which port folio would you invest in and why? Justify. Make suitable assumptions as necessary. [10]
- b) Define simulation, what are the various characteristics necessary for simulation? Explain any two of them. [10]

Q4.

Explain the following :-

- a) Methodology to account for inflation effect and risk effect during capital budgeting. [8]
- b) What do you understand by sensitivity analysis? [2]

Q5. Write Short notes on any 4: [20]

- a) Risk Assessment Tables
- b) mitigation of unquantified risk
- c) RAMP
- d) LCP

e) Decision tree analysis

Q6.

[20]

The client associated with Infrastructure development has decided to evaluate two highway proposals with the following cash flows.

Option I			Option II		
Year	Cash Inflow (Rs.)	Cash Outflow (Rs.)	Year	Cash Inflow (Rs.)	Cash Outflow (Rs.)
1	-	10,00,000	1	-	35,00,000
2	-	35,00,000	2	10,00,000	2,00,000
3	-	20,00,000	3	12,00,000	3,00,000
4	15,00,000	2,00,000	4	15,00,000	50,000
5	20,00,000	3,00,000	5	11,00,000	50,000
6	25,00,000	2,00,000	6	9,00,000	1,50,000
7	30,00,000	3,00,000	7	3,00,000	2,50,000

The decision criteria is based on NPV at 12%. Work out the values and suggest.

- Whether both proposals are worth investing, and
- The better alternative, stating reason.

BB-Con. 10365-16.

CBSGS

80 Marks

3 Hours

- Note: 1. Attempt any 4 Questions 2. All questions carry equal (20) marks
 3. Figures to the right indicate marks 4. Attempt sub questions in order
 5. Assume any data, if required, and state them clearly

1. (a) Clearly bring out the difference between the terms cost, price and value. [5]
 (b) Discuss the different types of values. [5]
 (c) What are the aims of value Analysis. [5]
 (d) How will you incorporate environmental concerns into product design? Discuss [5]

2. (a) Discuss the main limitations of value Analysis. [5]
 (b) What are the main steps in Value Analysis. [5]
 (c) The estimated cost of an expressway to be constructed on BOT basis between 2 megacities is ₹ 4097 crores. The project is to be completed in 4 years and the expected life of the project after vehicles start plying on it is 25 years; after which it needs to be scrapped off and replaced. The commissioning period for the contractor is 10 years, after which the project becomes government property. The contractor had taken a bridging loan of ₹500 crores (on simple interest of 12%p.a) at the start of the project which is to be repayed back between the years 6-10 of the project life cycle in equal yearly instalments. The cashflows at the end of each years are estimated as follows: [10]

Year No.	Construction costs In crore₹	Expected Toll to be collected In crore₹	Expected Repairs and maintenance In crore₹	Year No.	Construction costs In crore₹	Expected Toll to be collected In crore₹	Expected Repairs and maintenance In crore₹
0				15		950	300
1	1032			16		960	330
2	1184			17		970	360
3	1129			18		980	390
4	752			19		990	420
5		800	115	20	200	1000	450
6		820	130	21		1015	490
7		840	145	22		1030	530
8		860	160	23		1045	570
9		880	175	24		1060	610
10		900	190	25		1075	650
11		910	210	26		1090	700
12		920	230	27		1000	750
13		930	250	28		900	800
14		940	270	29		750	700

Determine, based on NPV, whether the project is feasible for both the project parties. Also show the BEP of the project. [10]

3. (a) Highlight some of the major differences between value engineering and Other cost reduction techniques. [7]
- (b) What are cause and effect diagrams. Explain their significance and methodology behind working. [7]
- (c) Explain in detail the role of SWOT and Break Even Analysis in value engineering. [6]
4. (a) Explain what do you understand by a Job Plan? [5]
- (b) What is value Engineering cell? Describe its functions and composition. [5]
- (c) What information does a value manual contain? [5]
- (d) Describe a cost cutting technique which would be very beneficial for civil engineering service industries. [5]
5. (a) The expected cash flows from 2 alternatives are as follows :-

Year No.	Project A	Project B
	in lakh ₹	in lakh ₹
0	(300)	(560)
1	(120)	220
2	(60)	240
3	(25)	250
4	500	180
5	460	160
6	300	100
7	225	40

For each alternative, determine

- Pay - back period.
- B/C ratio at 15% interest rate.
- IRR for Project 'A' (Approximate value)

Which investment alternative you would prefer and why? Justify. [12]

5. (b) Explain the different phases involved in value engineering operation under taken in a manufacturing organisation. [8]
6. (a) State and explain the factors responsible for product design and development. [5]
- (b) Define value, value analysis and value engineering. Discuss in details. [5]
- (c) Explain Function analysis system techniques (FAST) in details. [5]
- (d) Discuss the role of ergonomics in design and development of new product. [5]

CBGS

3 Hours

Total marks :80

Attempt any four questions.

Legible handwriting and practical examples will be appreciated

Q.1

- Define Quality. Why is it required in any project? Enlist the various dimensions of quality.
- Define TQM. What are its basic concepts?
- What are the steps involved in ISO-9000 certification? Enlist the benefits of this quality system.
- What is Kaizen? What are its features? Briefly explain 5S concept.

(20)

Q.2

- Write a note on Demings contribution to the field of TQM.
- Enlist the principles of TQM. What are the barriers in the effective implementation of TQM?

(20)

Q.3

- What is Quality function deployment? Explain its objectives, process and benefits.
- Write a detailed note on steps involved in benchmarking process.

(20)

Q.4

- Write a note on FMEA with a suitable example of any construction activity.
- Discuss the importance of checklist for effective implementation of quality on a construction site. Prepare a checklist to be ensured for a concreting activity.
- Differentiate between Quality control and Quality assurance.

(20)

Q.5

- Explain how leadership is important for a good TQM system. How does a good leader empowers his employees?
- You are the manager for the implementation of quality in a construction company. You have to improve the quality of internal and external plastering being executed on the site. Suggest :
 - Ways to identify existing poor quality issues.
 - Quality of workmanship to be achieved.
 - Physical and chemical properties of the materials to be used.
 - Preventive measures to ensure quality.

(20)

Q.6

- What are the different quality statements of an organization? What are the duties of quality council in achieving them?
- Write a detailed note on major elements of ISO-14000 or similar EMS standards.

(20)

CBGS

3 Hours

Total marks : 80

Answer any four questions.

Neat, labeled sketches, legible handwriting & practical examples will be appreciated.

- Q.1
- a What are the objectives and functions of material management?
 - b Explain balancing of equipment with a suitable example.
 - c What are the different methods of quality control?
 - d What is ABC Analysis?
 - e Enlist the advantages and disadvantages of safety stocks.
- Q.2
- a Write a note on the indices used for assessment of effectiveness of inventory management. (20)
 - b Write a note on equipment log book. 10
 - c Explain Just in time concept. 05
- Q.3
- a Explain the importance of an effective site layout. Draw a site layout for : (20)
 - i. Construction of a bridge.
 - ii. Construction of a railway station.
 - b What care is to be taken while storing and handling different construction materials on a site?
- Q.4
- a How does the scheduling of men, materials and equipments result in increase in the efficiency of a construction project? 10
 - b Explain what is empowerment of employees. How does it affect the overall productivity and efficiency of a construction company? 10
- Q.5
- a Write a note on the indices used for assessment of effectiveness of inventory management. (20)
 - b What are the factors affecting the selection of construction equipment? Explain with an example how balancing of equipments is important for optimum utilization of equipments.
- Q.6
- Write short notes on (Any four) (20)
 - a Economic order quantity.
 - b Primary & secondary objectives of material management.
 - c Order point control.
 - d Importance of vendor analysis.
 - e Importance of quality inspections on site.