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IV/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION

November,2022

Civil Engineering

Seventh Semester

Construction Management

Time: Three Hours

Maximum: 50 Marks

Answer Question No. 1 Compulsorily.

(10X1 = 10 Marks)

Answer ANY ONE question from each Unit.

(4X10=40 Marks)

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|----|---|----------|----|
| 1. | a) Define controlling | CO1(BL1) | 1M |
| | b) Define construction management | CO1(BL1) | 1M |
| | c) Define Float | CO2(BL1) | 1M |
| | d) Distinguish between CPM and PERT | CO2(BL1) | 1M |
| | e) Define PERT | CO2(BL1) | 1M |
| | f) Define Resource Smoothing | CO1(BL1) | 1M |
| | g) Define Resource Leveling | CO3(BL1) | 1M |
| | h) Name various network techniques in construction management | CO3(BL1) | 1M |
| | i) What is the importance of safety in construction | CO4(BL1) | 1M |
| | j) Differentiate between quality control and assurance | CO4(BL1) | 1M |

Unit - I

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|----|---|----------|----|
| 2. | a) Explain in detail about the objectives of construction management | CO1(BL1) | 5M |
| | b) Discuss about the various steps involved in planning with advantages | CO1(BL1) | 5M |

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| 3. | Explain the main causes of Project Failure. | CO1(BL1) | 10M |
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Unit - II

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| 4. | The following table gives the activities in the construction of a project | CO2(BL2) | 10M |
|----|---|----------|-----|

Activity	Duration(days)
1-2	20
1-3	25
2-3	10
2-4	12
3-4	6
4-5	10

Draw the network for the project and find the critical path. Determine the free float, total float and independent float.

(OR)

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|----|--|----------|----|
| 5. | a) Explain the steps involved for optimization of cost | CO2(BL1) | 5M |
| | b) Explain different types of floats | CO2(BL1) | 5M |

Unit - III

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|----|---|----------|----|
| 6. | a) Write a short note on the following | CO3(BL1) | 5M |
| | i. ABC classification of materials | | |
| | ii. Stores management | | |
| | b) Explain the Earth work Excavation equipment. | CO3(BL1) | 5M |

(OR)

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|----|--|----------|----|
| 7. | a) List various types of earthmoving equipment | CO3(BL1) | 5M |
| | b) Explain various factors affecting the selection of equipment. | | |

Unit - IV

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|----|--|----------|----|
| 8. | a) Write a short note on the following | CO4(BL2) | 5M |
| | i. Safety budgeting | | |
| | ii. Total quality control | | |
| | b) Describe the importance of documentation in construction management | CO4(BL1) | 5M |

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|----|---|----------|----|
| 9. | a) Write a short note on the following | CO4(BL1) | 5M |
| | i. Quality control circles | | |
| | ii. Documentation | | |
| | b) Explain the safety benefits to Employers, Employees and Customers. | CO4(BL1) | 5M |



1. a) Define controlling. CO1(BL1) 1M
Ans: Controlling is complimentary to planning. Once the project has been planned, scheduled and started, the progress of the work has to be checked with the original one.

- b) Define construction management CO1(BL1) 1M
Ans: The action of building something, typically a large structure. And it starts with planning, design, and financing and continues until the structure is ready for occupancy.

- c) Define Float CO2(BL1) 1M
Ans: Float denotes the flexibility range with in the activity start and finish times may fluctuate without affecting the total project duration.

- d) Distinguish between CPM and PERT. CO2(BL1) 1M
Ans: CPM is an activity oriented network while PERT is event oriented.

- e) Define PERT. CO2(BL1) 1M
Ans: Program Evaluation Review Technique (PERT) is a project management planning tool used to calculate the amount of time it will take to realistically finish a project.

- f) Define Resource Smoothing. CO1(BL1) 1M
Ans: If duration of completion of the project is the constraint, then resource smoothening should be applied without changing the total project duration .the period of minimum demand for resources are located and the activities are shifted according to the float availability and requirement of resources. Thus the intelligent utilisation of floats can smoothen the demand of resources to the maximum possible extent. This type of resources allocation is called “resource smoothening”.

- g) Define Resource Leveling. CO3(BL1) 1M
Ans: The process of resource levelling is, whenever the availability of resource becomes less than its maximum requirement, the only alternative is to delay the activity having larger float. In case, two or more activities require the same amount of resources, the activity with minimum duration is chosen for resource allocation. Resource levelling is done if the restriction is on the availability of resources.

- h) Name various network techniques in construction management. CO3(BL1) 1M
Ans: Critical Path Method and Program Evaluation Review Technique

- i) What is the importance of safety in construction? CO4(BL1) 1M
Ans: It's important to save lives and prevent injuries, harm etc. from workplace.

- j) Differentiate between quality control and assurance. CO4(BL1) 1M
Ans: Quality Assurance is defined as an activity that ensures the approaches, techniques, methods and processes designed for the projects are implemented correctly.
Quality Control ensure that the approaches, techniques, methods and processes are designed in the project are following correctly. Quality control activities operate and verify that the application meet the defined quality standards

Unit - I

2. a) Explain in detail about the objectives of construction management.

CO1(BL1) 5M

Ans:

Objectives of Construction Management or Factors involved in Construction management:

- 1) Speed of construction.
- 2) Control on quality of materials and workmanship.
- 3) Optimum utilization of Manpower.
- 4) Optimum utilization of Machinery.
- 5) Economy in Construction.
- 6) Coordination between different agencies involved in Construction.
- 7) Facilitate the execution in a planned and efficient manner.

- b) Discuss about the various steps involved in planning with advantages.

CO1(BL1) 5M

Ans:

Steps involved in Planning;

1. **Crystallizing the opportunity or problem.** The first step in planning would be to find out the problem or identify the opportunity to be seized. This is necessary to be able to formulate practical and realistic objectives.

2. **Securing and analyzing necessary information.** Adequate information is required on course of action possible. It is necessary to determine the nature of the information required and where this information will be available. This information must be analysed to establish the relationship and tabulate them for adequate interpretation.

3. **Establishing planning premises and constraints.** An analysis of the data so collected will result in the formulation of certain assumptions on the basis of which the plan will be made through a process of forecasting. Constraints such as government control will also exist. Planning will be in the backdrop of such premises and constraints which must be watched to detect changes and their effect on the plans.

4. **Ascertaining alternative course of action or plan.** Based on the above analysis, possible alternative course of action will be identified and examined. Generally, every situation will have more than one course of action. Exploitation of the right course will depend to a large extent on experience, ingenuity and imagination of the planner.

5. **Selecting optimum plan.** An evaluation of the above alternate course of action can be carried out either by judgement alone or with the help of quantitative techniques and staff assistants, to best suit the interest of the organisation.

6. **Determining derivative plan.** The above selected plan will form the basic plan from which other plans will develop to support it. For example, basic marketing plan may have been evolved which may result in other derivative plans such as the advertising plan.

7. **Fixing the timing of introduction.** The question of timing-who will do, what will have to be decided and an appropriate time schedule drawn up with the details of construction work for communication.

8. **Arranging future evaluation of effectiveness of the plan.** Since the ultimate aim of the plan is to achieve the objective, results or goal, an evaluation at the earliest possible opportunity is necessary to evaluate the adequacy of cost and time and determining whether the planned objectives are reached as desired.

Advantages of Planning;

1. Advantages to the contractors:

- i. The fact that the job has been studied in detail in order to draw up a network or a bar chart means that the contractors knows more about the job.
- ii. A property drawn up programme in conjunction with cost control can prevent the loss of money and help to relieve the financial burden of the contractor.
- iii. Supply of labour required week by week for each operation can be gauged properly if a program has been drawn up earlier
- iv. It is a simple matter to produce various schedules from the programme.
- v. The programme provides a standard against which actual work can be measured.
- vi. A programmer lays down a preconceived plan not only for the whole job but also for the various stages in the job.

2. **Advantages to the Clients:** The client will know exactly how long it will take to construct the building and for what length of time his capital will be unproductive, while tied up in construction work.
3. **Advantages to the Architects/Engineers**
 - i. The programme will normally be prepared by the contractor in close consultation with the architect.
 - ii. After the contractor has prepared a concise picture of the construction in the form of a programme and the target has been laid down for the various operations, then a draft should be submitted to the architect or engineer for his approval.
 - iii. The plan may be different from one another where their objectives and mode of operations are different from each other.
 - iv. The technique of preparing a plan has no effect on it.
 - v. The difference between two plans can be judged by their objectives and mode of execution of the operations and not by the techniques adopted to prepare them.

(OR)

3. Explain the main causes of Project Failure.

CO1(BL1) 10M

Ans:

Main Causes of Project failure:

- It is not uncommon to see a project failing to achieve its mission of creating a facility within the specified cost and time.
- Hardly few projects get completed in time and within original costs.

The factors contributing are as follows:

1) Inadequate project formulation: poor field investigation, inadequate project information, bad cost estimates, lack of experience, inadequate project analysis, and poor investment decisions.

2) Poor planning for Implementation: Inadequate time plan, inadequate resource plan, inadequate equipment supply plan, inter-linking not anticipated, poor organisation, poor cost planning.

3) Lack of proper contract planning and management: Improper pre-contract actions, poor post award contract management.

4) Lack of project management during execution: Inefficient and ineffective working, delays, changes in scope of work and location, law. There can be endless reasons for non-fulfillment of project objectives. Failures can be due to unforeseen natural calamities like earthquakes, floods and natural disasters.

Cost Estimation Failure:

- Cost Estimation is a continuous process. It calls for financial commitments at various levels and by various agencies involved in the project.
- The client or the promoter, basing his judgment on the feasibility cost estimates, accepts engineering costs and signals the start of the engineering phases of the project.
- During this phase, his professional team or the consultants develop the design, the specifications, and the drawings which lead to the formulation of bill of quantities (BOQ).
- The BOQ contains work quantity estimates, and also indicates the approximate cost.
- At this stage, the client may review the cost commitments prior to giving the go-ahead for the tendering action.
- On receipt of work tenders from the client's consultants, the contractor prepares his detailed estimate within specified tendering period.
- He quotes his estimated price for the work itemized in the BOQ, and this tendered cost becomes his financial commitment for executing the works.
- Acceptance of the contractor's quoted tender by the client implies his commitment for the payment of the quoted cost.
- Based on the quantities and cost reflected in the BOQ, the contractor's project planner draws up his plan of work.
- This plan forecasts the contractor's commitment for resources and input costs and consequently, the revenue which he can expect.
- This estimation process continues during the execution stage. The contractor's cost accounts, based on information from the site, undertakes the accounting commitment including accounting of actual costs, analysing variances from estimated costs and indicating the cost trends.
- The progress estimator (of the client) responsible for the interim payments estimates the contractors payments based on prices quoted in the BOQ and thus

implies a commitment for the correctness of part payment to the contractor.

- Finally, on completion, the final bill prepared by the contractor undergoes a scrutiny by the consultant, and this scrutinized bill gives the final estimate of project costs to be incurred by the client.

- There are various methods employed for estimating the project costs. These included: unit cost estimation, parameter estimation, factor estimation, range estimation and detailed contractor's estimation.

- The method used depends on the purpose for which the estimate is required, the degree of accuracy desired and the estimating effort employed.

- The following are the rough guidelines for selecting the appropriate method of estimation.

(a). Inception stage: The estimation is initially based on the prevailing unit cost of the facility. Some examples of unit cost estimation are given below

- The prevailing cost depends upon many factors such as the location, specifications, resources availability, working conditions, and the political environment. This estimation method, called the unit cost method, needs little time and effort, sometimes just a few hours, to compute the cost, provided the prevailing rates are available.

(b) Preparatory stage:

- The BOQ, prepared during the engineering stage, provides data for estimating the approximate cost by using any of the following two methods:

- i. Computing direct costs for each item of work and adding fixed percentage for indirect costs, contractor's profit and consultancy charges.

- ii. Computing costs using the factor estimate or parameter estimate methodology, provided sufficient past performance data is available.

- The cost estimates thus derived are 10-20% on the accuracy range and the time taken depends on the scope of the project, availability of the past performance data, and the method of execution.

the ranges of accuracy of this methods is roughly 40% and, therefore, it has to be further refined by using other estimating techniques when the architectural and structural drawings are prepared and other related information becomes available.

(c) Contractor's tendering and execution stage:

- This estimate is based on the tendered BOQ and the contract stipulations.

- Tendering requires detailed estimation as inaccuracies both on plus and minus side can adversely affect the project feasibility and contractor's business respectively.

- Preparation of detailed estimation is a time consuming process and its accuracy (ranging from 2-10%) depends on the time and resources available for the preparation of estimation.

- Despite the well-established methodology for project estimation, the glamour of hefty profits and the security of the everlasting market, financially, construction business till remains risk proposition.

- Unlike other industries where the sale price of the product is determined after its manufacture, in construction, generally the works are priced before they are produced.

- This estimation of costs before the completion of the project adds to the business risk of the client as well as the contractors.

- A construction contractor always gambles when he bids for a fixed price contract. A bid on the higher side may mean an opportunity missed for new business, where as a quotation on the lower side may imply less profits, or possibly a loss or in some cases, even the contractor's bankruptcy.

- When the contractor wins a bid for quoting the lowest, his fellow bidders may question his judgement.

- A construction project based on inaccurate cost estimates is bound to fail unless its performance objectives are revised and/or additional funds inducted.

Management Failure:

- A project environment comprises various interrelated constituents such as resources, tasks, and technology along with the people working against time under stress and strain, all of these combined together to achieve the common project objectives.

- The problems of management are so complex that they defy simple solutions. Some of these are beyond the management's control but some can be avoided.

Unit - II

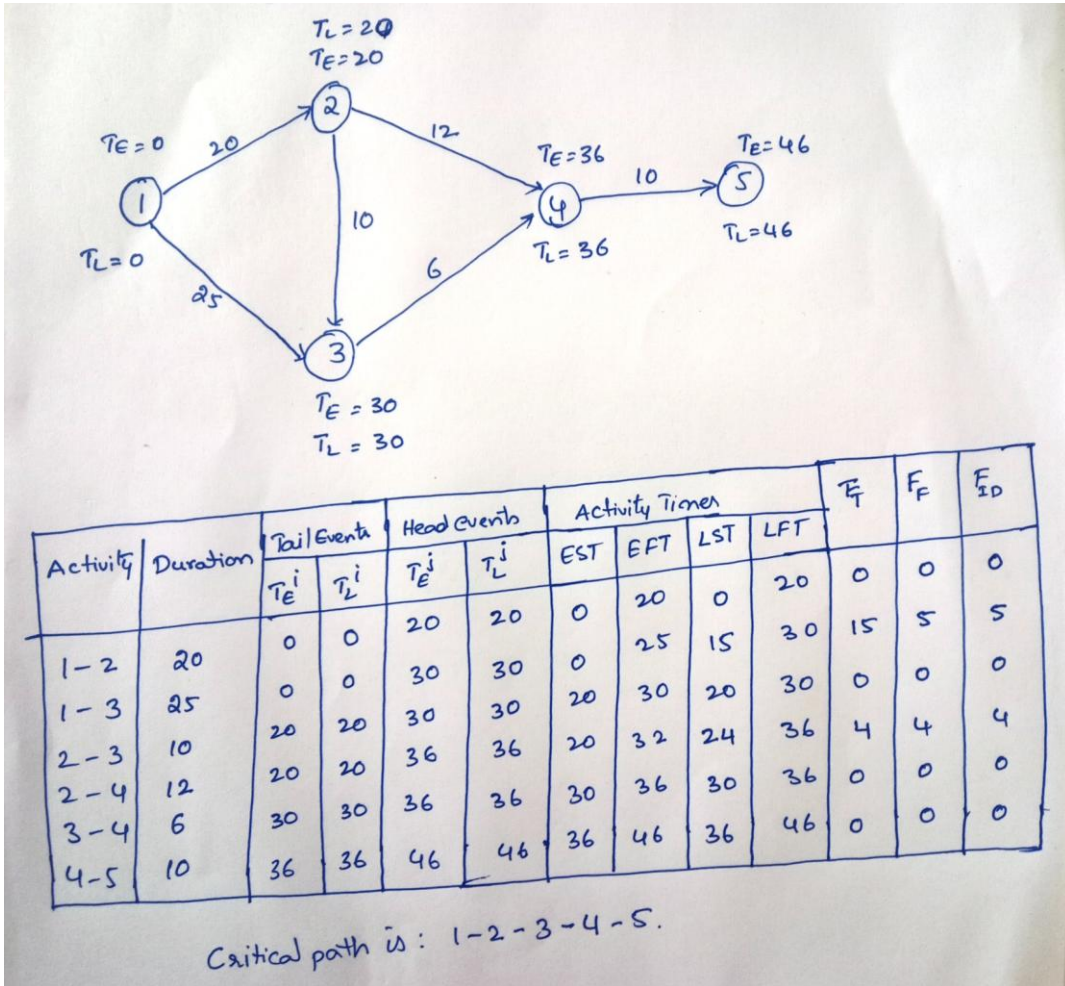
4. The following table gives the activities in the construction of a project

CO2(BL2) 10M

Activity	Duration(days)
1-2	20
1-3	25
2-3	10
2-4	12
3-4	6
4-5	10

Draw the network for the project and find the critical path. Determine the free float, total float and independent float.

Ans:



(OR)

5. a) Explain the steps involved for optimization of cost.

CO2(BL1) 5M

Ans:

Steps involved in optimization of cost:

1. Analyze the past records and determine the direct cost versus time relationships for various activities.
2. The cost slopes for different activities are calculated and is arranged in the ascending order.
3. Compute the direct cost for the network with normal duration of activities.
4. The activities in the critical path are crashed as per ranking starting from the critical activity having the least cost slopes.
5. The crashing of critical activities is continued in ascending order of the slopes.
6. The parallel non-critical activities are crashed which have become critical by the reduction of critical path duration due to crashing in previous steps.
7. The crashing of activities is continued till a stage is reached beyond which no further crashing is possible.
8. At every stage of crashing, calculate the total project cost by adding direct and indirect costs.
9. The total cost-duration curve is plotted.
10. The optimum duration corresponding to the least total project cost is obtained from the curve.

b) Explain different types of floats.

CO2(BL1) 5M

Ans:

Float denotes the flexibility range with in the activity start and finish times may fluctuate without affecting the total project duration.

There are 4 types of floats:

1. Total float.
2. Free float.
3. Independent float and
4. Interfering float.

Total float: total float is the time span by which the starting or finishing of an activity can be delayed without affecting the overall completion of project.

$$F_T = LFT - EFT = LST - EST$$

Free float: free float is that duration by which an activity can be delayed without delaying any other succeeding activity.

$$F_F = T_E^j - EFT = FT - S_j$$

Independent float: it is the excess time available if the preceding activity ends as late as possible and the succeeding starts as early as possible.

$$F_{ID} = F_F - S_i$$

Interfering float: interfering float is the differences between the total float and free float. This is equal to the head event slack. This is the potential downstream interference.

$$F_{IT} = F_T - F_F$$

Unit - III

6. a) Write a short note on the following
- i. ABC classification of materials
 - ii. Stores management.

CO3(BL1) 5M

Ans:

ABC classification:

This is a basic management tool enabling the top management to concentrate the efforts where the results will be maximum. This is the technique is called as the Always Better Control or Alphabetic Approach. Here, effort is made to analyse the annual consumption of materials in organisation, it will be noticed that a handful of items making less than 10% of the total stock will account for substantial portion – about 75% of the total expenditure on materials. These are called as ‘A items’ and needs the careful attention of the materials manager. In a similar manner, a large number of materials which are at the bottom line making about 70% of the stock are classified as ‘B items’.

Those between the A and B items are called the ‘C items’. This approach will help the material manager to concentrate on costly A items among the lakhs of store items. By this approach, the manager is able to control inventories and show excellent results in a short period of time. Many organisations have benefited in reduced clerical costs and in better planning and improved turnover

- b) Explain the Earth work Excavation equipment.

CO3(BL1) 5M

Ans:

1. Power shovels, 2. Back Hoe, 3. Drag Line, 4. Clam Shell, 5. Trench Machines,
6. Scrapers, 7. Bull Dozer.

Explanation of any two equipment can be award for 5 marks.

(OR)

7. a) List various types of earthmoving equipment.

CO3(BL1) 5M

Ans:

Here's a list of some of the most prominently used earth-moving equipment in the construction industry:

Excavators
 Backhoe Loaders
 Bulldozers
 Skid-Steer Loaders
 Trenchers

1. Excavators

These heavy machines consist of a base cabin and a long arm with a bucket attachment at its end. They use a hydraulic system to function. The operator controls the excavator from the base cabin which is capable of rotating 360°. The base cabin is placed on a supporting structure with either wheels or tracks.

Excavators are widely used in both small as well as large construction sites. Their applications include excavation, demolition, heavy lifting, grading, landscaping,

mining, dredging and more.

2. Backhoe Loaders

Backhoe loaders or backhoes are tyre mounted machines with a shovel at the front and a bucket attached to a jointed arm at the rear end. They look quite similar to farm tractors and their mobility makes them ideal for use in urban areas. Backhoe loaders are medium-sized machines that can be used for applications such as excavation works, digging trenches, placing pipes, filling up trenches, lifting materials, etc. Some backhoe loaders come with

b) Explain various factors affecting the selection of equipment.

Ans:

Factors Affecting the Selection of Construction Equipment:

1. Standard Types of Equipment

There is no clear definition of standard equipment. Equipment that is standard for one contractor may be special for another. But it may be defined as the equipment that can be used economically on more than one project, its repair parts may be obtained more quickly and it can be easily disposed of at more favourable price.

2. Special Equipment:

It is the equipment that is manufactured for use on single project or for a special type of operation. Such equipment may not be suitable or economical for use on other project.

3. Replacement Parts:

Prior to purchasing equipment, the buyer should determine where spare parts are obtainable; otherwise the project may be delayed. If parts are not obtainable quickly, it may be wise to purchase other equipment, for which parts are quickly available, even though the latter seems less desirable.

4. The Cost of Owning and Operating Construction Equipment

There are several methods of determining the probable cost of owning and operating construction equipment. No known method will give exact costs under all operating conditions. At best the estimate is only a close approximation of the cost. Kept records for equipment previously used should give information which may be used as a guide for the particular equipment it was used under the same conditions. Factors that affect the cost of owning and operating construction equipment include:

1. The cost of the equipment delivered to the owner.
2. The severity of the conditions under which the equipment is used.
3. The number of hours the equipment is used per year.
4. The number of years the equipment is used.
5. The care with which the owner maintains and repairs the equipment.
6. The demand for used equipment when it is sold, which will affect the salvage value.

When it is necessary to estimate the cost of owning and operating construction equipment prior to purchasing it, cost records, based on past performance generally will not be available, therefore the following costs should be considered:

5. Ownership Costs:

Depreciation cost.

Depreciation: Is the loss in value of a piece of equipment over time, generally caused by wear and tear from use, the profitable owner of equipment must recover this loss during its useful life

i. Investment Cost.

Owning equipment costs money, one part of ownership costs is Investment costs which include the following:

- The interest on the money invested.
- Taxes of all types which are assessed against the equipment.
- Insurance.
- Storage.

The rates for these costs vary among different owners, with location and whether or not the equipment is actually used.

6. Operating costs:

Operating costs are those costs associated with the operation of a piece of equipment. Operating costs usually occur only when the equipment is being used; it includes:

i. Maintenance cost.

The annual cost of maintenance and repairs may be expressed as a percent of the annual cost of depreciation.

ii. Repair parts cost.

When operating under standard conditions, a gasoline engine will consume approximately (0.06 gal, 0.23 liter) per each flywheel horsepower hour, while a diesel engine will consume approximately (0.04 gal, 0.15 liter) per each flywheel horsepower hour. Engines used in construction industry seldom operate at a constant output or at a rated output, except for short periods of time, also, construction equipment is seldom operated the entire 60 min in an hour.

iii. Lubrication and fuel.

The quantity of lubricating oil used by an engine will vary with the size, the capacity of the crankcase, the condition of the piston rings and the number of hours between oil changes.

Unit - IV

8. a) Write a short note on the following
- i. Safety budgeting
 - ii. Total quality control

CO4(BL2) 5M

Ans:

Safety budgeting

Safety is an association with precaution. A precaution for a calamity, that may/ may not occur. If it does not occur then nothing better but if it does occur, then the budget of the whole company can go in for a toss, really bad.

Health, Safety & Environment Officer of a company, know how challenging it is to plan or forecast a safety budget. Especially when we are analysing and referring to the data of your organization, and the hard truth and the reality of the hazards and accidents that your employees have gone through, is on the papers with facts and figures staring back at you.

Total quality control

Total quality control is a broad-ranging set of techniques that are employed to minimize errors throughout an organization. By doing so, an organization can greatly improve both its profits and customer satisfaction. It requires the involvement of employees across the organization who are empowered to make changes. This approach involves a number of concepts, which include:

- The customer's perception of quality is what matters.
- Error reduction focuses on process improvements.
- Processes must continually be improved, so there is no end to the total quality control effort.

There must be continual feedback loops and close integration of motivational tools with the quality improvement goal.

- b) Describe the importance of documentation in construction management.

CO4(BL1) 5M

Ans:

The importance of documentation :

a few key benefits you can share to illustrate why documentation should be a priority moving forward.

1. A single source of truth saves time and energy

Estimates state that the average knowledge worker spends about two and a half hours per day searching for the information they need. Effective documentation collects all of the must-know information about a task, project, or team (from account logins to step-by-step instructions) in a centralized, organized place. No more digging through email or downloaded files for the latest information.

When you're handing off a task, planning for a new project, or need to have a different team member step in on something, documentation means you're able to keep the gears turning without spending hours trying to track down details, credentials, directions, and more.

Writing down your processes is helpful for spotting bottlenecks and bloated workflows, so you can further streamline the way your team works.

2. Documentation is essential to quality and process control

There's more than one way to get things done, and you want to give your team the flexibility to approach their work in a way that suits them best.

But, at the same time, you want to ensure consistent results – especially when it comes to things that you're producing on a regular basis. There needs to be some level of cohesion so that you don't look sloppy or uninformed.

Documentation encourages knowledge sharing, which empowers your team to understand how processes work and what finished projects typically look like.

With those resources in hand, your team members don't need to be mind readers to maintain consistency of repeated projects like that monthly report or that quarterly presentation. They still have wiggle room to get creative while confirming that they're checking all of the must-have boxes.

3. Documentation cuts down duplicative work

How many times have you started a new project only to find out it had been done before? Companies that use documentation to catalog past projects, collect research, and share decisions benefit by reducing re-work that wastes precious time you could be using elsewhere.

Why reinvent the wheel when you can just build on the work that's already happened? With documentation in place, you can refer to past work and learn from

it, instead of doing it all over again with the same results.

4. It makes hiring and onboarding so much easier

It's tough to think about anybody leaving, but the reality of business is that your team won't stay the same forever. People will hit the road and you'll bring some new people into the fold.

When you're welcoming new team members, that onboarding period can be daunting, both for your existing team and for that new employee. And, unfortunately, Gallup found that only 12% of employees strongly agree that their organization does a great job of onboarding new workers.

You want to educate and empower team members to do their best work, rather than making them feel like they're thrown to the wolves.

If you prioritize documentation, they'll have all sorts of helpful guides, directions, and notes that they can refer to as they get up to speed in their new roles. Plus, they can use those resources to answer their questions and start to figure things out independently, rather than feeling like they need to ping someone on your team with every single question or sticking point.

5. A single source of truth makes everyone smarter

At work, we tend to treat our knowledge as currency. If we're the person with all of the answers, it provides us a sense of security, as if we're the most irreplaceable person on our team. We assume that sharing our expertise will make us less valuable.

That's why it's little surprise that one survey found that 60% of employees have had a difficult time getting their colleagues to share information that is vital to their work.

(OR)

9. a) Write a short note on the following
- i. Quality control circles
 - ii. Documentation

CO4(BL1) 5M

Ans:

QUANTITY CIRCLES

In addition to the services of the quality control team, in some of the projects, quality control circles are formed. This is a small group to perform quality control activities voluntarily within the same organization. Employees from all hierarchical levels meet to discuss their problems, isolate them and find solutions. It is a bottom-up approach of problem solving. This group carries on continuously the quality control activities with all members participating.

Documentation: The quality of the construction works should be documented properly through check lists, registers and log books. The records should be continuously updated.

- b) Explain the safety benefits to Employers, Employees and Customers.

CO4(BL1) 5M

Ans:

SAFETY TO EMPLOYERS

- Because safety and profit have an integral relationship, the discussion on safety itself would become a moot question for discussion if construction companies were not making a profit.
- There is no lack of humanitarian concern if we view safety from a profit stand point, provided, we recognize that it is profitable not only to the employer but to the worker as well.
- The construction employer who disregards safety suffers an indirect cost which could ultimately affect his survival also.
- With at least half of construction cost consisting of labor, any constructive type of safety program will result in economics and be of great importance to the worker, to the contractor, and to the public as a whole.
- It is not difficult to see that accidents and losses involving both people and equipment results in a waste of time and money.
- Also, an employer believes that as long as he has provided for insurance to protect himself against direct losses resulting from accidents, he has no longer any concern as to profit and loss, once he has paid that insurance premium.
- This attitude can lead to disastrous results and a simple evaluation of the

relationship between insured cost and uninsured costs will reflect the importance of this relationship.

- Uninsured costs are approximately nine times greater than insured cost. Thus, for every one rupee in direct loss or cost of an accident, nine additional rupees are spent indirectly.
- **Insured cost include:**
- Injuries
- Medical and hospital costs.
- Pensions for dependents.
- Compensation for lost earnings
- **Property Damage:**
- Insurance premium or charge:
- Fire.
- Public liability.
- Uninsured cost which results in indirect losses are as follows:
- Injuries
- First aid expenses.
- Cost of investigations

SAFETY TO EMPLOYEES

- Any accident that results in reducing a worker's physical power, creates serious challenges to that worker projected manhood.
- If this is coupled with a pain and anguish that the worker and his family experience, the loss cannot be compensated for special care must be afforded to the injured worker in both physical and mental rehabilitation. By safety, all these can be eliminated.

SAFETY BENEFITS TO CUSTOMERS

- As the expenses of industrial accidents are to be consider as cost of operation, and as such, are to be transferred from the worker and employer to the customer, eventually, the customer will bear the cost of poor accident prevention programs.
- It's very possible that immediate cost will not affect the customer, particularly in the case of fixed bid contract construction, but the effect that losses due to injury creates with in the cost of providing workmen's compensation insurance will eventually be felt.
- The cost of a project as viewed by the customer includes not only the price of customer but also the cost of non-productive capital.

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