USN | | | | | | | | | | |

Internal Assessment Test 1 –December 2022

Sub:	CONSTRUCTION MANAGEMENT & ENTREPRENEURSHIP					Sub Code:	18CV51	Branch:	CIVIL
Date:	01.12.2022	Duration:	90 min's	Max marks:	50	Sem / sec:	5/A		OBE

Answer all questions. Assume any missing data suitably.

	MARKS	CO	RBT
1. Define labour production rate or productivity? What are the factors affecting the labour productivity?	[10]	CO1	L1
2. Differentiate between quality control and quality assurance? Explain the TQM process in construction?	[10]	CO1	L1
3. Explain the operational and maintenance cost of construction equipments? Explain selection of construction equipment?	[10]	CO1	L1
4. List out various Inventory Control Techniques adopted in Material Management and Explain A-B-C analysis ?	[10]	CO1	L1
5. Estimate the hourly production in bulk volume (LCM) of a backhoe with bucket capacity of 0.96 cubic meters that is employed on excavation of a foundation, which is 4m deep in hard digging soil. The excavated earth is to be loaded in waiting dump trucks, placed at a swing angle of 75^0. The expected performance efficiency is 83%. Assume the ideal output of face shovel with given bucket capacity is 150 LCM. Assume and list the suitable corrections to be applied.	[10]	CO1	L3

1.Define labour production rate or productivity? What are the factors affecting the labour productivity?

Ans:

Labour productivity may be defined as the ratio of output and labour input. In other words, it is the productivity of an industry measured in terms of labour input. For the purpose of productivity analysis, the average product, rather than marginal, is considered relevant because the latter fails to reveal the actual and potential level of productivity in their representative character.

The input of labour may be taken as number of workers or man-hours worked during the period. This ratio may be computed for one worker or group of workers in a unit ofwork or for the plant as a whole depending on the need.

There is another way of measuring labour productivity. For a given worker or group of workers doing a job, the enterprise fixes certain target volume of output in a given day or period**.**

FACTORS AFFECTING LABOUR OUTPUT OR PRODUCTIVITY

1. **Overtime***:* Scheduling of extended work days or weeks exceeding a standard eight-hour work day or 40- hour work week lowers work output and efficiency through physical fatigue and poor mental attitude
2. **Morale and Attitude***:* Spirit of workers based on willingness, confidence, discipline,and cheerfulness to perform work or tasks can be lowered due to a variety of issuesincluding increased conflicts, disputes, excessive hazards, overtime, over- inspection, multiple contract changes, disruption of work rhythm, poor site conditions, absenteeism, unkempt workspace, and so on.
3. **Work complexity***:* A simple, familiar work, is easier to execute than an unfamiliar, complex one. The extra effort needed for the latter type of work, especially in the initial stages, may range from 10-100% of the normal expected productivity.

4. **Repetition of work:** While the first-time execution of an unfamiliar work needs extraeffort and results in low output, the skill acquired in the process, when utilized overa period of time to execute similar works, improves productivity rate.
5. *Equipment-intensive tasks:* The construction equipment executes works speedily, but it needs

operators. The equipment-intensive tasks are less susceptible to productivity changes than the labour-intensive ones.

6. **Equipment-intensive tasks:** The construction equipment executes works speedily, but it needs operators. The equipment-intensive tasks are less susceptible to productivity changes than the labour-intensive ones.
7. **Supervision:** An efficient and effective supervisor can get a higher productivity from labourers.
8. **Dilution of Supervision***:* This occurs when supervision is diverted from productive,planned, and scheduled work to analyse and plan contract changes, expedite delayedmaterial, manage added crews, or other changes not in the original work scope andschedule. Dilution is also caused by an increase in manpower, work areas, or project size without an increase in supervision.
9. **Labour availability***:* The labour productivity also depends upon the employment opportunities available in the market. If jobs are plenty and labour is scarce, the labour productivity tends to become less. In scarce job situation, the overall productivity improves since the employers can then sort out labour with a light productivity.
10. **Mobilize/Demobilize***:* This relates to moving resources on and moving off to projects as a result from changes or delays, causing work disruptions. Productivity may drop during these periods as time is lost when crews move from one area or work assignment to another.
11. **Errors and Omissions:** Increases in errors and omissions impact on labour productivity because changes are then usually performed on a crash basis, out of sequence, cause dilution of supervision, or any other negative impacts.
12. **Start/Stop**: This results from a work stoppage or suspension of work, which may cause a break in the schedule, usually triggering a start/stop of work activity. Stop-starts can have an impact on productivity and cost of a project
13. **Site Access***:* This is a result of interferences to the convenient or planned access to work areas. This can be due to blocked stairways, roads, walkways, insufficient man-lifts, or congested work sites.
14. ***Hazardous Work Area*:** This is caused when working in an area that is classified as hazardous, requiring special safety equipment and clothing. Restrictions may limit time and exposure of workers to the area, resulting in less time on tools in the area.
15. **Climatic and weather conditions***:* Performing work in a change of season, temperature

zone, or climate change resulting in work performed in either very hotor very cold weather, rain or snow, or other changes in temperature or climate can impact workers beyond normal conditions. Since construction projects are. spread over several months or even years, it is necessary to adjust the effect of weather changes month-by-month on worker's productivity as well as work execution.

16. **Role of management***:* The project management has a key role to play in planning and controlling productivity. It.is responsible for specifying the weekly target of work to be accomplished by the workers as well as how the works are to be executedand using which resources.

2.Differentiate between quality control and quality assurance? Explain the TQM process in construction?

Ans:

Quality Control: It's a process of quality management
Establishes standards for construction
It's a base of execution of quality work.
It has planned quality control procedures.
Plan will be comprehensive, detailed and logical

Quality Assurance: It is by the means by which construction department ensures the completed project complies with the quality established by the contract documents.

Quality Assurance	**Quality Control**
Its a managerial tool	Its a corrective tool
Set of activities for ensuring quality when product is being developed	Focus on identifying defects when the product is actually produced
Verification is done	Validation/ Software testing is done
Establishes a good system by doing periodic audits of all the operation in the system	Finds & Eliminates sources of faults through tools and equipment.

Total Quality Management

TQM is a way of planning, organizing and understanding each activity that depends on each individual at each level. Ideas of continuous learning allied to concepts such as empowerment and partnership, which are

facets of TQM, also imply that a change in behaviour and culture is required if construction firms are to become learning organizations.

This is a complete management philosophy that permeates every aspect of a company and places quality as a strategic issue. Total quality management is accomplished through an integrated effort among all levels in a company to increase customer satisfaction by continuously improving current performance. TQM is a management-led approach applicable in all the operations of a company and the responsibility of ensuring quality is collective.

Management commitment and leadership

i. Training
ii. Teamwork
iii. Statistical Methods
iv. Cost of Quality
iv. Supplier Involvement

It is believed that adoption of TQM by construction companies will result in higher customer satisfaction, better quality products and higher market share. However, adoption of TQM requires a complete turnaround in the corporate culture and management approach, as compared to the traditional way of top management giving orders and employees merely obeying those.

Construction, being different from manufacturing and other industries, has many unique problems that cause hindrances in adoption of TQM. Some of the major problems identified are:

1. Lack of teamwork

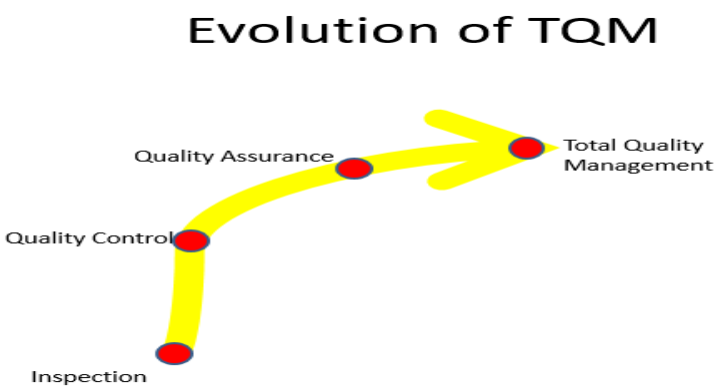
2. Poor communication

3. Inadequate planning and scheduling

1. No team-building exercises at the inception of projects

2. Lack of understanding of team members' expectations

3. Little or no team-oriented planning and scheduling



3. Explain the operational and maintenance cost of construction equipments? Explain selection of construction equipment?

Ans:

2.15.1 Cost of Operating Construction Equipment

Operating costs of the construction equipment, which represent a significant cost category and should not be overlooked, are the costs associated with the operation of a piece of equipment. They are incurred only when the equipment is actually used. The operating costs of the equipment are also called "variable" costs because they depend on several factors, such as the number of operating hours, the types of equipment used, and the location and working condition of the operation.

Equipment operating costs are the direct costs associated with equipment operations. Unlike ownership cost, an operating cost is not a fixed cost but a variable one, directly proportional to the amount of work performed or operating hours. An operating cost is incurred only when the equipment is actually being used. The operating costs vary with the amount of equipment used and job-operating conditions.

The best basis for estimating the cost of operating construction equipment is the use of historical data from the experience of similar equipment under similar conditions. If such data is not available, recommendations from the equipment manufacturer could be used.

2.15.2 Maintenance and Repair Cost

The cost of maintenance and repairs usually constitutes the largest amount of operating expense for the construction equipment. Construction operations can subject equipment to considerable wear and tear, but the amount of wear varies enormously between the different items of the equipment used and between different job conditions. Generally, the maintenance and repair costs get higher as the equipment gets older. Equipment owners will agree that good maintenance, including periodic wear measurement, timely attention to recommended service and daily cleaning when conditions warrant it, can extend the life of the equipment and actually reduce the operating costs

Tire Cost

The tire cost represents the cost of tire repair and replacement. Because the life expectancy of rubber tires is generally far less than the life of the equipment on which they are used on, the depreciation rate of tires will be quite different from the depreciation rate of the rest of the vehicle.

The repair and maintenance cost of tires as a percentage of their depreciation will also be differentfrom the percentage associated with the repair and maintenance of the vehicle.

Consumable Costs

Consumables are the items required for the operation of a piece of equipment that literally gets consumed in the course of its operation. These include, but are not limited to,

fuel, lubricants, and other petroleum products. They also include filters, hoses, strainers, and other small parts anditems that are used during the operation of the equipment.

a) Fuel Cost

Fuel consumption is incurred when the equipment is operated. When operating under standard conditions, a gasoline engine will consume approximately 0.06 gal of fuel per flywheel horsepowerhour (fwhp-h), while a diesel engine will consume approximately 0.04gal/fwhp-h. A horsepower hour is a measure of the work performed by an engine.

b) Lubricating Oil Cost

. The quantity of oil required by an engine per change will include the amount added during thechange plus the make-up oil between changes. It will vary with the engine size, the capacity of rankcase, the condition of the piston rings, and the number of hours between oil changes.

Mobilization and Demobilization Cost

Equipment moving and setup costs or mobilization costs, and dismantling or demobilization costs can be substantial and must be considered. This is the cost of moving the equipment from one job site to another. It is often overlooked because of the assumption that the previous job would have already paid for it. Regardless of these calculations, the costs of equipment mobilization and demobilization can be large and are always important items in any job where substantial amounts of equipment are used.

These costs include freight charges (other than the initial purchase), unloading cost, assembly or erection cost (if required), highway permits, duties, and special freight costs (remote or emergency).

Equipment Operator Cost:

Operator's wages are usually added as a separate item and added to other calculated operating costs. They should include· overtime or premium charges, workmen's compensation insurance, social ·security taxes, bonus, and fringe benefits in the hourly wage figure. Care must be taken by the companies that operate in more than one state or that work for federal agencies, state agencies and private owners.

SELECTION OF CONSTRUCTION EQUIPMENT

1.**Site condition**: Primary site condition (actors are: types of material to be handled, physical constraints onsite, and hauling distances.

2.The Nature of the Work: Some factors relating to the nature of the work include payload, the total quantity of work, and the construction schedule. Payload has a direct relation to the capacity of the equipment selected.

3.Size of the Equipment: Size of equipment should be such that it must be ableto be used with other matching units. If the equipment selected is of larger size, that will remain idle for most of the time or sha1l work on part loads, which means production cost will be more. On other side, if the equipment isof smaller size than desired, the equipment will not be able to work with thematching equipment's and hence other equipment's will have to remain idleor to be allowed to work on part loads, which shall again be uneconomical.

4.Standardisation: It is better to have same type and size of equipment's in theproject. It means lesser spare parts reserve, more interchangeability of parts if required, easy for the operators to understand it, mechanics will be able tomaintain and repair better as they become expert by handling similar type ofequipment.

5.Availability of Equipment: The equipment which is easily available in the market should be purchased. It should also be ensured that the equipment is of repute and is likely to be continued to be manufactured in future also. Thisis necessary for future standardisation and ensuring spare parts supply. It is easy to dispose of such equipment after completion of projects.

6.Availability of Spare Parts: While selecting a particular type or make of equipment, it should be ensured that the spare parts will be available at reasonable price throughout the working life of the equipment. It should alsobe ensured that the downtime of the equipment for want of spare parts may not be more. This is all the more necessary in case of imported equipment's.

7.Multipurpose Equipment's (Versatility): There are certain types of equipment's which ae not utilised fully. Therefore, if possible, they must be capable of performing more than one function for example, excavator with wheel loader bucket arrangement or with rock breaker attachment.

8.Client-and Project-specific: The owner/client in a certain project may have certain preferences that are not in line with the construction company's preferred policies as far as equipment procurement is concerned. The schedule, quality and safety requirements demanded of a particular project may in some cases force the company to yield to the demands of the client.

9.Labour Consideration: Shortage of manpower in some situations may lead to a decision in favour of procuring equipment that is highly automated.

10.Use in Future Projects: When equipment completes only a part of their usefullife in a project, it should be kept in view that the equipment can be used in future projects and may not become obsolete.

11.Economic Considerations: The economic considerations such as owning costs, operating labour costs and operating fuel costs of equipment are most important in selection of equipment. Besides, the resale value, the replacement costs of existing equipment, and the salvage value associated with the equipment are also important.

12.Reliability of the Equipment: Equipment selected for the project must be reliable one.

Service Support: Service support should be available in the area of project where the equipment shall be used. Service after sales is a major criterion forselection of equipment.

Operating Requirements: The equipment selected should be easy to operate and maintain, acceptable to the operator and should have lesser fuel consumption.

13.Past Performance*:* If the equipment being purchased is of new make and model, it is desirable to enquire about its performance from other users, whoare using this make and model.

4. List out various Inventory Control Techniques adopted in Material Management and Explain A-B-C analysis ?

Ans:

Inventory is simply a stock, of physical assets having some economic value which can be either in the form of material, money or labour. Inventory is also known as an idle resource as long as it is not utilised. Inventory may be regarded as those goods which are procured, stored and used for day-to-day functioning of the organisation.

Inventory control is the technique of maintaining stock items at desired levels. In other words, inventory control is the means by which material of the correct quality and quantity is made available as and when it is required with due regard to economy in the-storage costs, ordering costs, set up costs, manufacturing costs, purchase prices and working capital.

There are following three main issues involved in inventory management and control:

- How and what to prioritize for procurement'?
- How much to order?
- When to order?

Objectives of Inventory Control

As inventory is an essential part of any organisation, it consists of many items running into thousands. Systematic management and control of inventory for all the items is a challenging job.

To maintain the overall investment in inventory at the lowest level, consistent with operating requirements,

To supply the product,- raw material, sub-assemblies, semi-finished goods, etc.

To its users as per their requirements at right time and at right price,

To keep inactive, waste, surplus, scrap and obsolete items at the minimum level,

To minimise holding, replacement and shmtage costs of inventories andmaximise the efficiency in production and distribution, and

To reduce the risk inherent in treating inventory as an investment which is risky.For some items, investment may lead to higher returns and for others less returns.

2.25 ABC ANALYSIS

This is based on Pareto's Law, which says that in any large group there are 'significant few' and 'insignificant many'. For example, only 20 per cent of the items may be accounting for 80 per cent of the total material cost procured by a construction organization. Here, the 20 per cent constitute the 'significant few' that require utmost attention.

To prepare an ABC-type curve, we may follow a simple procedure:

1. Different materials required for the project are identified and their estimated quantities worked out. The quantity estimate could be on the basis of either annual consumption or the project's total requirement.
2. The unit rates of materials are estimated.
3. The usage values for each of the materials are obtained by multiplying the estimated quantities and their unit rates. These values are converted into percentage of total annual usage cost or total project cost, as the case may be.
4. The percentage usage cost for each of the materials is arranged in the descending order of their ranking, starting with the first rank, i.e., highest to lowest usage value. The cumulative percentage usage value is also calculated.
5. A curve as shown in Figure 2.10 is plotted, and points on the curve at which there are perceptible sudden changes of slopes are identified. In the absence of such sharp points, cut-off points corresponding to the top 10 per cent and the next 20 per cent or so are marked as a general indicator of A, B and C type of materials.
6. According to an empirical approach, 'A' class items account for about 70 per cent of the usage value, 'B' class items for about 20 per cent of the usage value, and 'C' class items for about 10 per cent of the usage value. In terms of numbers, 'A' class items constitute about 10 per cent of total items, 'B' class items about 20 per cent of total items, and 'C' class items about 70 per cent of total items. These percentages are indicative only and can vary depending on a number of factors.

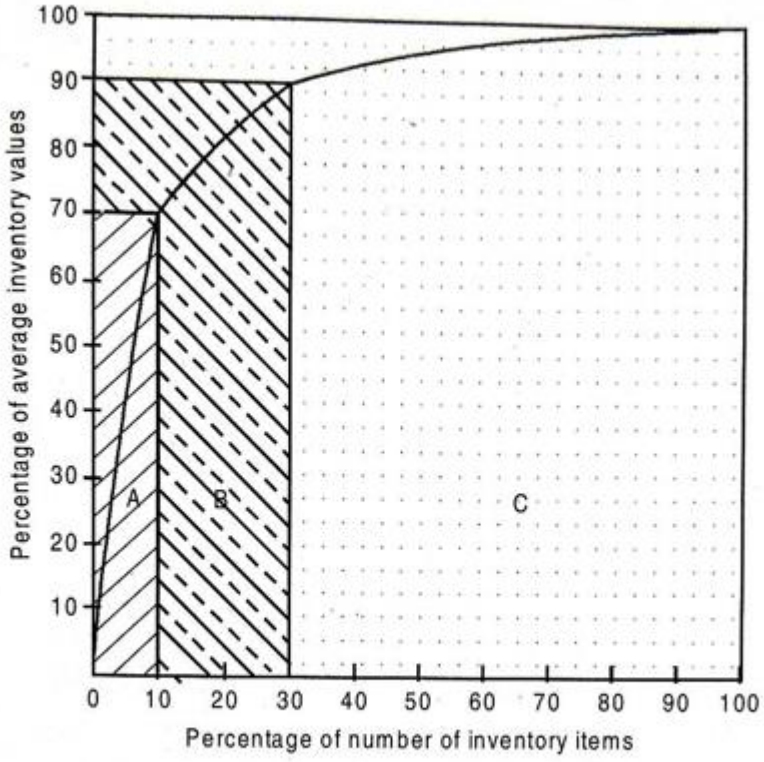


Fig. 2.10 : Illustration of ABC analysis

5. Estimate the hourly production in bulk volume (LCM) of a backhoe with bucket capacity of 0.96 cubic meters that is employed on excavation of a foundation, which is 4m deep in hard digging soil. The excavated earth is to be loaded in waiting dump trucks, placed at a swing angle of 75^0. The expected performance efficiency is 83%. Assume the ideal output of face shovel with given bucket capacity is 150 LCM. Assume and list the suitable corrections to be applied.

(a) Ideal output of loose soil in cubic mt (LCM) = 150. (given).

(b) Equipment conversion factor.
Operating @ optimum depth = 0.80

c) Correction factor are.

(i) Soil factor for digging = 0.67

(ii) Load factor for loading into vehicle = 0.80

Swing factor for 75°

Soln.

ideal output = 0.8 × 150 =

Correction factor = 0.67 × 0.8 × 1.05
= 0.56.

Performance efficiency = 0.80.

hence expected output /h = ideal output × correction factor × performance efficiency
= 120 × 0.56 × 0.80
= 1.2) 48 LCM/hr.