

# CBCS SCHEME



Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

## Construction Management and Entrepreneurship

18CV51

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Discuss the ideal characteristics that a Management should exhibit. (07 Marks)
- b. Briefly explain the key steps involved in Construction planning. (06 Marks)
- c. What are the principles based on which organizational structure has to be framed? (07 Marks)

### 1 a. Nature & characteristics of management

1. Management is an activity: Management is a process of organized activity which is concerned with the efficient use of resources of production. Resources include materials, money & people in the organization.

2. It is a purposeful activity: It is concerned with the achievement of an objectivity these functions such as planning, organizing, staffing, directing & controlling

3. It is concerned with the efforts of a group: management is concerned with management of people & not the direction of thugs. It inspires & motivates works to put forth their efforts to the maximum extent.

4. Management is getting things done: Management is the art of getting things done their & with people in formally organized groups.

5. It applies economic principles: Management is the art of applying the economic principles that underlie the control of men & materials in the enterprise under consideration.

6. Involves decision-making: Management in the decision making process & the decisions are involved in all the functions of management.

7. It Co-ordinates all activities & resource: It is concerned with the Co-ordination of all activities & resources it's various functions to attain the stated objectives.

8. It is a universal activity: It manager irrespective of the enterprise in which they are working & their place in the organization shuttered make use of the management principles.

9. IT is an integrating process: It integrates men, machines & materials for carrying out the operations of the enterprise & for achieving the stated objectives.

10. It is concerned with direction & control: It in concerned with the direction & control of various activating the enterprise to attain the business objectives.

11. It is intangible: It is abstract & cannot be seen with the eyes. It is evidenced by the quality of organization & results such as increased productivity.

12. Management is both science & an art: It has developed certain principle & laws which are applicable of to any group activity.

13. It is a proffers ion: Because there are established principles of management which are being applied in practice.

14. It is an interdisciplinary approach: Management as a body of discipline takes the help of other social sciences.

15. It is an economic resource: There are five factors of production land, labor, capital, management. The entrepreneur establishes the organization as owner & it is the management which transforms these resources these in to productive process.

16. It is a system authority: As management is a process of directing men to perform a task, authority to extract work from others, it is implied in the busy concept of management.

### 1. b Steps in planning:

- Step-1 Stating organizational objectives
- Step-2 List the alternative channels of reacting the objectives
- Step-3 Develop premises on which each alternative is listed
- Step-4 Select the best alternative which first in to organizational objectives.
- Step-5 Prepare a sound plan out of selected alternative This will be a master plan which contains various functional Plans.
- Step-6 Implement the designed plan

Various steps:

#### 1. Awareness of opportunities of problems:

- a. What business opportunities or problems are likely to come?
- b. What are the plans for exploiting the opportunities?
- c. Whether it is necessary to devise a new plan or is it sufficient to execute existing plan.
- d. By making changes in the plan, what is the benefit to the organization?

#### 2. Collecting & analyzing information

To collect the information & data related to planning should be made & analyzed.

#### 3. Determination of objectives:

Analysis & interpretation of data facilitates in determining the enterprise objectives. Objectives should be specific & clean.

#### 4. Determining planning premises & constraints

Premises are planning assumptions on the basis of which planning takes place. Some premises like population growth & political environment are uncontrollable while some degree of control can be exercised on the technology used. Some constraints like government control affect the plans.

5. Finding out the alternative courses action

For every plan there are number of alternatives & hence all possible alternatives to work out a plan for achieving the desired objectives should be found out for then evaluation.

6. Evaluation of alternatives & selection

Alternatives are in reference to cost, speed, quality & select best course of action.

7. Determining secondary plans

This is to support the basic plan. For example, a number of secondary plans for purchasing of raw materials, acquisition of plant & machinery & aiming of workers have to be prepared for successful operation of the basic plan.

8. Securing participation of employees.

The successful execution of plan depends on the extent of Co-operation of the employees. Management involves employees in planning the communication.

1. c. Organizational Structure is made based on the following 9 principles

1. Unity of Objectives.
2. Division of Work and Specialization.
3. Delegation of Authority.
4. Coordination.
5. Unity of Command.
6. Flexibility.
7. Simplicity.
8. Span of Control.
9. Authority and Responsibility.

- 2 a. What is Work break down structure? Mention its significance in Construction project. (06 Marks)
- b. Discuss suitability, advantages and disadvantages of Autocratic and Democratic style of Management (06 Marks)
- c. Draw the network diagram and identify critical path using CPM for the following activity data :

|                 |     |     |     |     |     |     |     |     |     |     |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Activity        | 1-2 | 2-3 | 2-4 | 3-5 | 3-6 | 4-5 | 4-7 | 5-8 | 6-8 | 7-8 |
| Duration (Days) | 5   | 2   | 6   | 4   | 4   | 2   | 3   | 7   | 8   | 2   |

(08 Marks)

2. a **Work breakdown structure (WBS)** in project management is a method for completing a complex, multi-step project. It's a way to divide and conquer large projects to get things done faster and more efficiently.

The goal of a WBS is to make a large project more manageable. Breaking it down into smaller chunks means work can be done simultaneously by different team members, leading to better team productivity and easier project management.

### **Significance:**

**WBS is used to plan scope, time, resources and cost of the project.** It is easy to plan a component of a project rather than planning a project as a whole. Your estimates will be more accurate and you will be more confident about your planning.

**WBS is used to organize activities of a project.** Projects have a large number of activities. It is important to organize them so that they are easily accessible and also we can communicate about activities better if they are well organized. For example if I have to update brickwork on lets say 10<sup>th</sup> storey of a 15 storey building in my schedule then it is difficult to find this particular activity if they are not organized.

**WBS is used to view combined data of activities.** This means that you can summarize your data at any WBS level. This data can be with respect to duration, cost or resources. For example you may want to see what is the total duration of all earthworks in your schedule or you may want to see what is the total or actual cost of all electrical works of you project. You can easily see this required information if you have elements of earthworks and electrical works in your WBS.

Similarly, this summarizing of data will enable you to monitor, control and report at any WBS level.

**WBS is also used to control access within a project.** For example you may need that all mechanical activities of a building project should be monitored by a mechanical staff person. Or you may have a subcontractor on your project and you want Them to monitor their scope of work. In these cases, you can assign a user to specific WBS of the project.

### Module-2

- 3 a. What is the purpose of having material management system in construction? (04 Marks)
- b. Enumerate the factors to be considered for selection of construction equipments. (07 Marks)
- c. Explain different class of labour employed in construction project. (09 Marks)

### 3. a. Objectives and Functions of Materials Management

- Efficient materials planning
- Buying or Purchasing
- Procuring and receiving
- Storing and inventory control
- Supply and distribution of materials
- Quality assurance

### 3. SELECTION OF CONSTRUCTION EQUIPMENT

The selection of the appropriate construction equipment is an important part of job planning. The contractor has many different options to choose from, which makes the

selection even more complicated. A planner has to choose the alternative that provides the best value from a cost and schedule perspective.

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

(b) *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.

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

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

*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. This is necessary for future standardisation and ensuring spare parts supply. It is easy to dispose of such equipment after completion of projects.

(f) *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 also be 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.

*Multipurpose Equipment's (Versatility)*: There are certain types of equipment's which are 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.

(h) *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.

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

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

(k) *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.

(l) *Reliability of the Equipment:* Equipment selected for the project must be reliable one.

(m) *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 for selection of equipment.

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

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

3. c. In India, traditionally the construction industry has been labour intensive as the labour is cheap and easily available. In general, there are three categories of manpower involved in this industry consisting of the skilled/semiskilled, unskilled and managerial/technical workers.

A construction activity is a very complex process, made up of many different systems, such as the structural system, exterior enclosure system, and HVAC system. These systems can be broken down into many more subsystems and sub subsystems. In this way, a construction project is divided into numerous work packages. These work packages can then be assigned to and completed by an individual worker or a crew. A crew is a team of workers, which can be of the same trade or a composite of many different trades. Due to the diverse nature of the different tasks associated with all the building systems, many types of craftsmen from many different trades are required in a construction project.

IS 10302: 1982, Indian Standards on 'Unified nomenclature of workmen for civil engineering, published by its Construction Management Section. Committee includes around 95 categories of labours. The trade categories and crew sizes used for determining construction output also varies with various agencies publishing output planning norms.

- 4 a. What are the factors influencing Inventory Management? (05 Marks)
- b. Estimate the hourly production of a Shovel with bucket capacity of  $0.96\text{m}^3$  and cycle time of 30 seconds. Shovel is used to excavate hard soil in an open area. Excavated earth is to be loaded in waiting dump truck, positioned at  $60^\circ$ . Equipment is utilized for 50 minutes in one hour. (07 Marks)
- c. List the factors affecting labour productivity. Briefly discuss any three factors. (08 Marks)

#### 4. a. Factors affecting Inventory Management

##### Purchase Price or Production Cost

The cost of the item is the money paid to the supplier for the item received or the direct manufacturing cost, if produced. It is normally equal to purchase price.

When the market prices go on fluctuating, planning for inventory is based on the average price mostly taken as a fixed price. The price factor is of special interest when price discounts can be secured or when large production runs may result in a decrease in the production cost.

##### *(a) Selling Price*

In some inventory situations, the demand may be affected by the quantity stocked. In such cases, the inventory model is based on a profit maximisation criterion which includes the revenue from selling the commodity. The unit selling price may be constant or variable, depending upon whether quantity discount is allowed or not.

##### *(b) Procurement Costs*

These costs are those incurred on a purchase (known as ordering costs) or incurred as set up costs related with the initial preparation of a production system if manufactured. These costs vary directly with each purchase order placed or with the set up made and are usually assumed independent of the quantity ordered or produced. Procurement costs include costs of administration (such as salaries of the persons concerned, telephone calls, computer costs, postage etc.), transportation of items ordered, expediting and follow up, receiving and inspection of goods, processing payments etc. This cost is expressed as the cost per order or per set up.

*(c) Shortage (or Stock out) Costs*

The demand pattern of commodity may be either deterministic or probabilistic. In the deterministic case, it is assumed that the quantities needed over subsequent periods of time are known with certainty. This may be expressed over equal periods of time in terms of known constant demands or in terms of known variable demands. The two cases are referred to as static and dynamic demands respectively.

*(d) Delivery Lag or Lead Time*

When the need of the material is felt and an order is placed, it may be delivered instantaneously or it may require sometime before delivery is affected. The time between the placement requisition for an item and its receipt for actual use is called delivery lag or lead time. In general, lead time has four components, viz. administrative lead time, supplier's lead time, transportation lead time and inspection lead time. While administrative lead time and inspection lead time can be fixed, the supplier's lead time and transportation lead time can never be fixed.

**4. c. Factors affecting labour Productivity:**

There are many factors that affect the productivity of labour in construction. Here are some of the most recognized factors affecting labour productivity in the construction industry:

1) *Overtime*: Scheduling of extended work days or weeks exceeding a standard eighthour

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 issues including increased conflicts, disputes, excessive hazards, overtime, overinspection,

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 extra

effort and results in low output, the skill acquired in the process, when utilized over

a period of time to execute similar works, improves productivity rate.

5) *Quality control*: Stringent quality control is sensitive projects, like in the construction of a nuclear reactor calls for frequent inspections, which involve elaborate documentation and is a time consuming task. They increase the nonproductive

time of workers and, in turn, reduces productivity by 10-25%.

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 delayed

material, manage added crews, or other changes not in the original work scope and schedule. 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. Stopstarts can have an impact on productivity and cost of a project.

Work scheduled or reassigned during holidays such as Festivals, New Year's, and so on are often impacted with stop-starts. Workers tend to discuss the time off and lose previous momentum with a drop in productivity before they get back in routine.

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 hot or 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 executed and using which resources.

### Module-3

- 5
- Define Engineering Ethics. Mention the duties of Engineers, with respect to ethical practices. (06 Marks)
  - Discuss the importance of Inspection in Construction. (08 Marks)
  - Highlight the common causes of accident in Construction site. (06 Marks)

### **5. a. Engineering Ethics:**

The term professional ethics is interchangeable with engineering ethics. Engineering Ethics deals with the moral issues and decisions confronting individual or organizations engaged in engineering. The questions about the moral ideals, character, policies and relationships of people and corporations involved in technological activities. Engineering Ethics is the activity and discipline aimed at understanding the moral values that may be used to guide engineering practice, resolving moral issues in engineering and justifying moral judgements concerning engineering.

Duties are moral obligations. The main duties that a person should perform are as follows:

- ▶ Respect for truth,
- ▶ Respect for laws,
- ▶ Respect for society and the state,
- ▶ Respect for life,
- ▶ Respect for freedom and personality.

### **5. b. Three Main Points of Construction Inspections**

**1. Budget.** Any construction inspections that handle money should always include the project's budget. The top priority for contractors and project managers is to complete a project within budget. Achieving this shows the efficiency and quality of their work. Inspections should consist of purchasing materials, payouts, labor activities, suppliers, and anything else pertinent to your construction project.

**2. Project Scope.** When an inspection is conducted, the leading factor of the process should always be a construction project's defined scope. The client's needs should be the primary focus of these inspections. Any changes made, communication history, reports, and checklists by the clients should be included because they approve or disapprove modifications to the project scope.

**3. Schedule.** Your construction project schedule directly affects your client's budget and needs, which can turn a satisfied client into a dissatisfied one, bringing costly litigation to the table. Utilize construction inspections to monitor your project schedule on a daily, weekly, and monthly basis. Always update all relevant stakeholders of any kind of delay, including their details.

The importance of construction inspection lies in a great inspection system that deals with errors and necessary changes. Having a good inspection system centered around the connectedness of your project teams will help you with the success of your construction

project and its on-time delivery. Here are five reasons why construction site inspections are essential for your company.

### **Hazard Identification**

As a project manager, safety is the number one priority. Construction inspections cover safety by identifying safe roads to transport equipment, safe gear for workers to use, potential hazards on the jobsites, and other dangers that might occur. After all, construction is a dangerous profession. Inspections ensure that proper precautions are taken for worker and site safety allowing your project workflows to maintain efficiency and quality.

### **Improved Construction Quality**

Quality is something companies always strive for when working on projects. It builds your reputation and your team's pride in the work they produce. However, high quality is met with high standards. To have high standards, inspections are needed to identify any regulation or code errors in your construction. Having excellent quality and following proper regulations will leave your client with a well-built structure.

### **Improved Communication**

Communication with all team members, whether on the jobsite or in the office, is critical to construction project management. A construction team's communication can be addressed with inspections if things aren't following the correct codes and regulations. On many projects, the work must be carefully coordinated to limit any risks that may occur. Construction inspectors oversee the job and are responsible for anticipating risk, communicating with the contractor, and documenting progress and possible construction or design issues for the owner. Knowing what needs to be changed from inspections can be beneficial to a team's communication.

### **Better Task Focus**

Inspections may be a pain sometimes, but they help those who work on a jobsite to maintain an alert state of mind. In simple words, this signifies that construction workers and agents have better concentration and more precise focus on what they are doing. What is more, they have all the necessary means for working efficiently given the fact that everyone is living up to the pre-established expectations.

### **Greener Construction**

There are specific environmental regulations for the construction industry to promote a greener construction environment. Inspections contribute to making construction companies follow them. The severe penalties that come from any potential environmental violations have been a great ally to the effort for a greener construction industry.

Construction inspections remain indispensable because they allow for safer conditions in the industry and a better way to monitor an ongoing project!

### 5. c. Common Causes of Accidents in a construction Industry:

1. Failing to identify an unsafe condition that existed before an activity was started or that developed after an activity was started.
2. Deciding to proceed with a work activity after the worker identifies an existing unsafe condition.
3. Carelessness of workers during the work i.e. the workers carrying heavy materials such as stones, bricks, cement concrete etc., at higher level by moving over temporary support and the painters and masons during plastering or masonry work..
4. During dismantling of the building, loose unprotected and unsafe parts such as walls, beam etc., results in accidents.
5. Due to overcrowding of workers at a particular spot of support there may be accident occurs due to failure of support
6. The greediness of contractor will lead to the accident

**OR**

- 6 a. Explain the safety measures to be adopted for excavation. (06 Marks)
- b. With reference to profession practice, discuss i) Conflict of Interest ii) Gifts and Bribes. (06 Marks)
- c. Explain the concept of Total Quality Management. (08 Marks)

1 of 2

### 6. a The following safety measures should be adopted at the time of excavation

1. In all works, an experienced and competent foreman or supervisor should look after the excavation work. He should have authority to enforce safety rules and prevent the use or defective/unsafe appliances.
2. Before doing the excavation work, a complete knowledge of underground structures (such as sewers, water pipe lines, gas mains, etc.) is essential.
3. Safety helmets should be worn by all persons entering a trench where hazards from falling stones, timber or other materials exist.
4. Whenever workmen have to excavate in trenches in soil, soft or fissured rock, or hard soil exceeding 2m in depth, the trenches should be properly shored and timbered.
5. Sheathing should be placed against the side of the trench so that the length of each piece of sheeting is vertical. Where the trench is excavated in loose or soft soil, each piece sheathing should be driven into the bottom of the trench so as to be firmly held in a place.

6. Excavated material should be kept away from the edge of the trench in order to provide a clear berm width not less than one third the final depth of excavation. However, in special cases where disposal area is limited, the minimum berm width should not be less than 1m.

6. b. Conflict of interest created by Interest in other companies

- Serving as a consultant for a competitor's company.
- Personal interest, such as making private investments in a competitor's company. Having partial ownership or substantial stock holdings in the competitor's business.
- It may not arise by merely having a spouse working for sub-contractor to one's company, but it will arise if one's job also includes granting contracts to that subcontractor.
- Tempting customers away from their current employer, while still working for them to form their own competing business.
- Moonlighting usually creates conflicts when working for competitors, suppliers or customers but does not conflict when working for others without affecting the present employer's business.

6. c. Gifts and Bribes:

| Bribe   | Gift  |
|---|---|
| 1. Given before   | Given after                                 |
| 2. Large amount   | Small amount, articles of daily use.        |
| 3. Usually poor quality of product.                     | May be good or high quality.                |
| 4. Given in secret.                                     | Given in open.                              |
| 4. Expect undue favour.                                 | Expect a favour or thanking for the favour. |
| 5. Damages the goodwill and reputation of organization. | No damage is involved to organization.      |

6. c. TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world-class competition.

Therefore, TQM is the art of managing the whole to achieve excellence. TQM is defined as both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. It is the application of quantitative methods and

human resources to improve all the processes within an organization and exceed customer needs now and in the future.

The TQM includes all activities like quality planning, quality operation and systematic evaluation. For attaining TQM in the organization, a total commitment and participation of all the members who are in the organization is essential. The responsibility for quality management should belong to top management of the organization.

TQM is a management-led approach applicable in all the operations of a company and the responsibility of ensuring quality is collective. The philosophy of TQM is one of prevention rather than defect detection. In other words, TQM is a way of thinking about goals, organizations, processes and people to ensure that -the right things are done right the first time. It is an approach to improving the competitiveness and effectiveness, and flexibility of the whole organization.

The essential elements of TQM are:

1. Management commitment and leadership
2. Training
3. Teamwork
4. Statistical methods
5. Cost of quality
6. Supplier involvement

**Module-4**

- 7 a. Define the following terms : i) Principal Amount ii) Rate of Interest  
iii) Interest Amount iv) Interest Period. (04 Marks)
- b. Discuss the principles of Engineering Economics. (06 Marks)
- c. There are two alternatives for purchasing a concrete mixer and details are as follows. Choose best alternative using PW method @ 10% rate of interest. (10 Marks)

| Parameter                                  | Alternative - 1 | Alternative - 2 |
|--|-----------------|-----------------|
| Purchase cost (Rs)                         | 3,00,000/-      | 2,00,000/-      |
| Annual Operating and Maintenance cost (Rs) | 20,000/-        | 35,000/-        |
| Expected Salvage value (Rs)                | 1,25,000/-      | 70,000/-        |
| Useful life (years)                        | 05              | 05              |

7. a. i) **Principal:** The original investment or the borrowed amount (i.e. loan) is known as the principal. The amount of interest indicates the increase between principal amount invested or borrowed and the final amount received or owed.

ii) **Rate of Interest:** When the interest amount is expressed as the percentage of the original amount per unit time, the resulting parameter is known as the rate of interest and is generally designated as 'i'.

iii) **Interest Amount:** Net increase over the amount of money that was originally invested or borrowed.

iv) **Interest Period:** The time period over which the interest rate is expressed is known as the interest period. The interest rate is generally expressed per unit year. However, in some cases the interest rate may also be expressed per unit month.

## 7. b. Principles of Engineering Economics:

The following are seven principles of Engineering Economics.

### **Principle 1 : Develop the alternatives**

The choice (decision) is among the alternatives. The alternatives are to be identified and then

defined for subsequent analysis. A decision situation involves making a choice among two or

more alternatives. Developing and defining the alternatives for direct evaluation is important

because of the resulting impact on the quality of the decision.

### **Principle 2: Focus on the differences**

Only the difference in expected future outcomes among the alternatives is relevant to their comparison and should be considered when making the decision. If all prospective outcomes

of the feasible alternatives were exactly the same, then there would be no basis or need for comparison. We would be indifferent to the alternatives and make decision on the basis of random selection.

### **Principle 3: Use a consistent viewpoint**

The prospective outcomes of the alternatives, economic and other, should be consistently developed from a defined viewpoint (perspective). It is important that the viewpoint for a particular decision be first defined and then used consistently in the description, analysis and

comparison of the alternative.

### **Principle 4: Use a common unit of measure**

Using a common unit of measurement to enumerate as many of the prospective outcomes as

possible will make easier the analysis and comparison of alternatives.



**Principle 5: Consider all relevant criteria**

Selection of a preferred alternative (decision-making requires the use of a criterion or several criteria). The decision process should consider both the outcomes enumerated in the monetary unit and those expressed in some other unit of measurement made explicit in a descriptive manner.

**Principle 6: Make uncertainty explicit**

Uncertainty is inherent in projecting for estimating the future outcomes of the alternative recognized in their analysis and comparison.

**Principle 7: Revisit your decision**

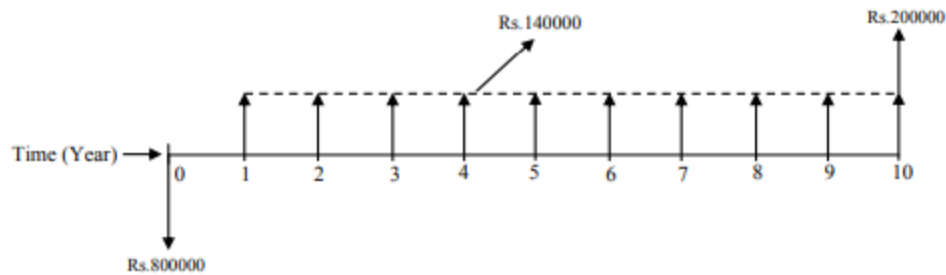
Improved decision-making results from an adoptive process. To the extent practicable, the projected outcomes of the selected alternative should be subsequently compared with the actual results achieved.

- o Problem recognition, definition and evaluation
- o Development of feasible alternatives
- o Development of cash flow for each alternative
- o Selection of criteria
- o Analysis and comparison of the alternatives
- o Selection of the preferred alternative
- o Performance monitoring and post-evaluation results

OR

- 8 a. Briefly explain the concept of Minimum Cost Analysis. (06 Marks)
- b. A Construction Company is planning to invest Rs 8,00,000/- for purchase of construction equipment with useful life of 10 years. Equipment is expected to generate net annual profit of Rs 1,40,000/- with expected salvage value of Rs 2,00,000/-. Compute the Rate of Return and comment on the investment if Company's MARR is 10%. (06 Marks)
- c. Initial cost of an infrastructure project, expected to serve perpetually is Rs 1,50,00,000/-. Annual maintenance cost is Rs 8,00,000/- Renovation cost at end of every 15 years is Rs 18,00,000/-. Find the capitalized cost at an interest rate of 8% per year. (08 Marks)

8. b. Cash Flow Diagram:



For determination of rate of return ' $i_r$ ' of the construction equipment, first the equation for net present worth of cash inflows and cash outflows is equated to zero. Then using the trial and error method the value of ' $i_r$ ' is determined. The net present worth of cash inflows and cash outflows of the construction equipment is given by the following expression.  $PW = -800000 + 140000(P/A, i_r, 10) + 200000(P/F, i_r, 10)$

For determining the value of ' $i_r$ ' the net present worth is equated to zero.

$$0 = -800000 + 140000(P/A, i_r, 10) + 200000(P/F, i_r, 10)$$

Now the above equation will be solved through trial and error process to find out the value of  $i_r$ . Basically a positive value and a negative value of the net present worth will be

determined at rate of return values close to the actual one and then by linear interpolation between these two values, the actual rate of return will be calculated. For finding out the rate of return values (close to the actual one), those will give a positive value and a negative value of net present worth, one has to carry out a number of trial calculations at various values of  $i_r$ .

Since MARR is 10%, first assume a value of  $i_r$  equal to 8% and compute the net present worth. Now putting the values of different compound interest factors in the expression for net present worth at  $i_r$  equal to 8% results in the following:

$$PW = -800000 + 140000(P/A, 8\%, 10) + 200000(P/F, 8\%, 10)$$

$$PW = -800000 + 140000 \times 6.7101 + 200000 \times 0.4632$$

$$PW = \text{Rs. } 232054$$

The above calculated net present worth at  $i_r$  equal to 8% is greater than zero, now assume a higher value of  $i_r$  i.e. 12% for the next trial and compute the net present worth.

$$PW = -800000 + 140000(P/A, 12\%, 10) + 200000(P/F, 12\%, 10)$$

$$PW = -800000 + 140000 \times 5.6502 + 200000 \times 0.3220$$

$$PW = \text{Rs. } 55428$$

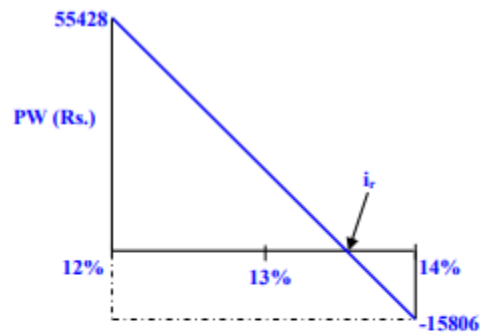
As observed from this calculation, the net present worth is decreased at higher value of  $i_r$ . Thus for getting a negative value of net present worth, assume further higher value of  $i_r$  than the previous trial and take 14% for the next trial and determine the net present worth.

$$PW = -800000 + 140000(P/A, 14\%, 10) + 200000(P/F, 14\%, 10)$$

$$PW = -800000 + 140000 \times 5.2161 + 200000 \times 0.2697$$

$$PW = -Rs.15806$$

Since a negative value of net present worth at  $i_r$  equal to 14% is obtained (as above), the actual value of rate of return is less than 14%. The actual rate of return is now obtained by doing linear interpolation either between 8% and 14% or between 12% and 14%. However for obtaining a more accurate value of rate of return, the linear interpolation is carried out between 12% and 14% and is given as follows;



$$PW = Rs.55428 \text{ at } i_r = 12\%$$

$$PW = -Rs.15806 \text{ at } i_r = 14\%$$

$$\frac{55428 - (-15806)}{14\% - 12\%} = \frac{55428 - 0}{i_r - 12\%}$$

On solving the above expression, the value of  $i_r$  is found to be 13.55% per year which is greater than MARR (10%). Now using the using Microsoft Excel spreadsheet and entering year-wise cash inflows and cash out flows, the value of rate of return is found to be 13.53% (using the function 'IRR'). However this minor difference in the value of  $i_r$  obtained from both the methods can be minimized by finding out the net present worth at narrow range of interest rate values and carrying out linear interpolation between these values (trial and error method) to find out the more precise value close to the actual rate of return.

The net present worth of the construction equipment at MARR i.e. 10% is given by;

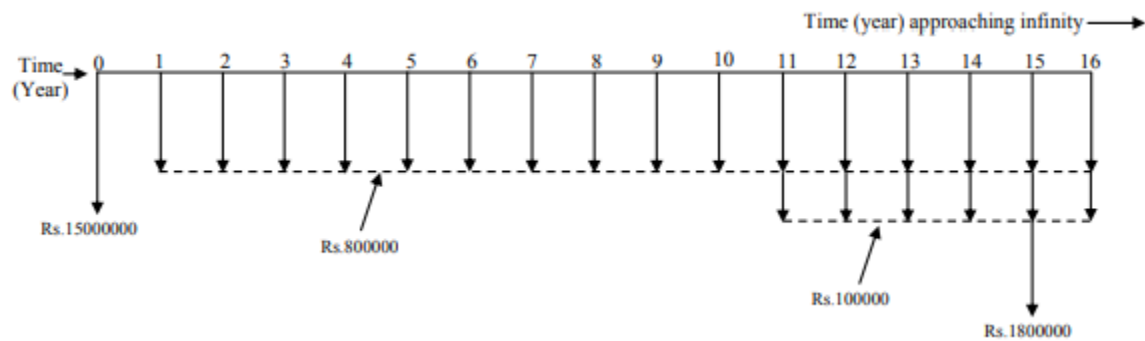
$$PW = -800000 + 140000(P/A, 10\%, 10) + 200000(P/F, 10\%, 10)$$

$$PW = -800000 + 140000 \times 6.1446 + 200000 \times 0.3855$$

$$PW = \text{Rs.}137344 \text{ at MARR (10\%)}$$

The net present worth of the construction equipment at MARR is greater than zero and the rate of return is greater than MARR. Thus the purchase of the construction equipment is economically justified. It may be noted here that when the equivalent worth of an investment is greater than zero at interest rate equal to MARR, then the rate of return of the investment is greater than MARR.

### 8. c. Cash Flow Diagram:



The annual operating cost is Rs.800000 for first 10 years followed by Rs.900000 thereafter. This can be represented as Rs.800000 from end of year 1 to infinite period of

time and Rs.100000 from end of year 11 to infinity as shown in Fig. 2.30. Thus the capitalized cost of the annual operating cost is equal to the sum of capitalized cost of these two components.

**Capitalized cost of the annual operating cost:**

$$\text{Capitalized Cost} = -\frac{800000}{i} - \frac{100000}{i} (P/F, i, 10)$$

In the above expression, the capitalized cost of Rs.100000 from end of year 11 till infinity is located at the end of year 10. Now the present worth (i.e. amount at time zero) of this amount is calculated by multiplying it with single payment present worth factor.

$$\text{Capitalized Cost} = -\frac{800000}{0.08} - \frac{100000}{0.08} (P/F, 8\%, 10)$$

$$\text{Capitalized Cost} = -10000000 - \frac{100000 \times 0.4632}{0.08}$$

**Capitalized cost = -Rs.10579000**

The capitalized cost of the annual operating cost can also be calculated by considering Rs.800000 from end of year 1 till end of year 10 and Rs.900000 from end of year 11 till infinity. The calculation is shown below.

$$\text{Capitalized Cost} = -800000(P/A, i, 10) - \frac{900000}{i} (P/F, i, 10)$$

In this expression, first the present worth of uniform series with annual amount of Rs.800000 for first 10 years is calculated. Then the capitalized cost of Rs.900000 from end of year 11 till infinity is calculated in the same manner as for Rs.100000 in the first approach.

$$\text{Capitalized Cost} = -800000(P/A, 8\%, 10) - \frac{900000}{0.08} (P/F, 8\%, 10)$$

$$\text{Capitalized Cost} = -800000 \times 6.7101 - \frac{900000 \times 0.4632}{0.08}$$

**Capitalized cost = -Rs.10579080**

Thus it can be seen that the capitalized cost of annual operating cost by both ways is same. The minor difference between the values is due to the effect of decimal points in the calculations.

**Module-5**

- |   |   |            |
|---|---|------------|
| 9 | a. Enumerate services offered by TECSOK.          | (06 Marks) |
|   | b. Discuss the characteristics of MSME's.         | (06 Marks) |
|   | c. Explain different concept of Entrepreneurship. | (08 Marks) |

9. a. TECSOK:

**Objectives:**

- a) To provide reliable consultancy support for entrepreneurs to startup self-employment ventures in Karnataka.
- b) To provide consultancy services to the various Departments and Agencies of state and Central Governments.

**Functions:**

- To identify investment opportunities which are location specific.
- To assist entrepreneurs in obtaining statutory and procedural clearances.
- To carry out feasibility studies and environmental impact studies.
- To assist preparation of detailed project reports as per investment norms and financial norm.
- To carry out market survey and research specific to industry needs.
- To assist in project implementation and extend turnkey assistance.
- To help in reorganization and restructuring of employees.
- To diagnose sick units and suggest rehabilitation measures
- To provide consultancy in valuation of assets, manpower, planning and budgetary control system
- To promote consultancy for merges and take overs.

9. B. Characteristics of MSME's:

Definition of MSMEs usually take into consideration the total assets, the level of turnover and the number of employees of the firm.

In India, the enterprises have been classified broadly into two categories:

- Manufacturing; and
- Those engaged in providing / rendering of services.

Both categories of enterprises have been further classified into micro, small and medium enterprises based on their investment in plant and machinery (for manufacture enterprises) or on equipment's (in case of enterprises providing or rendering services). The present ceiling investment to be classified as micro, small or medium enterprises is as under:

| Classification | Investment Ceiling for Plant, Machinery or Equipments *@          |   |
|----------------|---|---|
|                | Manufacturing Enterprises   | Service Enterprises   |
| Micro          | Upto ₹ 25 lakh (\$50 thousand)                                    | Upto ₹ 10 lakh (\$20 thousand)                                      |
| Small          | Above ₹ 25 lakh (\$50 thousand) and Upto ₹ 5 crore (\$ 1 million) | Above ₹ 10 lakh (\$20 thousand) and upto ₹ 2 crore (\$0.40 million) |
| Medium         | Above ₹ 5 crore (\$1 million) and upto ₹ 10 crore (\$2 million)   | Above ₹ 2 crore (\$0.40 million) and upto ₹ 5 crore (\$1 million)   |

Along with this prime objective, the MSMEs will have to contribute significantly for:

1. Creating self sufficiency in the business areas.
2. Reduction of regional imbalances.
3. Optimum use of all resources of production and consumption.
4. Establishing main employment centres.
5. Fulfil quality demands of the core sector industries.

9. c. It is a process undertaken by entrepreneur to augment his business interests. It is defined as an indivisible process flourishes, when the interlinked dimensions of individual psychological entrepreneurship, entrepreneur traits, social encouragement, business opportunities government policies, availability of resources, opportunities coverage towards the common good, development of society & economy.

Entrepreneurship in today's context in the product of teamwork & ability to crate, build & work as team. It is also a process of identifying opportunities in the market place, arranging the resources required to pursue these opportunities & inverting the resources to exploit the opportunities for better gains.

- OR**
- 10 a. List the benefits for investors and host country in Direct Foreign Investment. (04 Marks)  
b. Briefly discuss challenges in International Entrepreneurship. (08 Marks)  
c. What are the different sources of Finance for Entrepreneur? Explain. (08 Marks)

10. a. Benefits for investors in the host country in Direct foreign Investment:

The wholly owned foreign subsidiary has been a preferred mode of ownership for entrepreneurs using direct foreign investment for doing business in international markets. Joint ventures and minority and majority equity positions are also methods for making direct foreign investments.

The percentage of ownership obtained in the foreign venture by the entrepreneur is related to the amount of money invested, the nature of the industry and the rules of the host government.

10. c. Sources of Finance for Entrepreneur.

Funding sources include self-finding, family and friends, venture capital and government sources