

5012 (2)

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Reg. No. ....

(REVISION — 2015)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

**CONSTRUCTION MANAGEMENT & SAFETY ENGINEERING**

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List any two types of establishments in engineering department.
2. Identify any two purposes of tender.
3. Define reorder level.
4. List any two methods of procuring of equipments.
5. Define entrepreneurship.

(5 × 2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Explain the different stages of construction project.
2. Distinguish between CPM and PERT.
3. List the complete steps involved in tendering.
4. List any six rules to be followed in recording measurements in M'book.
5. Discuss the various welfare measures for labour.
6. Explain the factors related to selection of equipments.
7. Write the basic principles of construction safety.

(5 × 6 = 30)

## PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

## UNIT — I

- III (a) Discuss the functions of construction management. 8  
 (b) Explain the job lay out with the aid of a typical sketch of a site. 7

OR

- IV (a) Draw the organisational set up of PWD and list any four main duties of Executive engineer. 8  
 (b) Explain the components of CPM network diagram with the help of any sample network diagram. 7

## UNIT — II

- V (a) Explain the merits and demerits of Item rate and Lump sum contract systems. 8  
 (b) Give classifications of different types of bill forms used in making payments stating the situations for adopting each one. 7

OR

- VI (a) Discuss the various recoveries to be made in the preparation of bills. 8  
 (b) Describe the role of specifications and its need in construction activities. 7

## UNIT — III

- VII (a) Give the names of any eight earth moving equipments and write the specific use of each one. 8  
 (b) Discuss the main role of trade unions. 7

OR

- VIII (a) Explain the functions of human resource management. 8  
 (b) Describe the ABC and VED principles in stores management. 7

## UNIT — IV

- IX (a) Explain the expectations of an entrepreneur. 8  
 (b) Discuss any seven elements in total quality management. 7

OR

- X (a) Compare managerial and entrepreneurial style. 8  
 (b) Discuss the merits and demerits of ISO 9000 standard. 7
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Revision: 15

Course code: 5012

**COURSE TOPIC: CONSTRUCTION MANAGEMENT & SAFETY ENGINEERING**

Q. No.	Scoring Indicator	Split up score	Sub Total	Total								
<b>PART A</b>												
I.1	Regular, Work charged establishment, ...	2x1	2									
I.2	Lower bid due to competition, Selection of right contractors, ...	2x1	2									
I.3	The level of material, at which a new order for the requirement of EOQ is placed.	2	2									
I.4	Outright purchase, Hire purchase, ...	2x1	2									
I.5	It is the purposeful activity of an individual or group under taken to initiate, promote and maintain or getting profit by production or distribution of economic goods and services.	2	2									
<b>PART B</b>												
II.1	<p><b>Briefing stage :-</b> Reporting stage- It is to formulate and specify project functions and permissible costs and approximate –Non technical and technical preliminary investigations including sampling and testing etc</p> <p><b>Designing stage:-</b>Important stage in construction-A realistic and detailed estimate, Project summary, detailed technical investigations, Detailed working drawings, Approvals etc.</p> <p><b>Tendering stage:-</b>Invitation of tenders from contractors, awarding of contracts, contract document preparations, project management control by terms and conditions etc.</p> <p><b>Construction stage:-</b>Execution of activities, supervision, monitoring on expenditure quality controlling as per plan and specifications</p> <p><b>Commissioning stage:-</b>Performance of structure is evaluated, Nature of maintenance is proposed. Completion of all works for ready to use and its recording. It is the transition between construction and final taking over.</p>											
II.2	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"><b>CPM</b></td> <td style="width: 50%;"><b>PERT</b></td> </tr> <tr> <td>Deterministic</td> <td>Probabilistic</td> </tr> <tr> <td>Activity oriented</td> <td>Event oriented</td> </tr> <tr> <td>Single time</td> <td>Three time estimate</td> </tr> </table>	<b>CPM</b>	<b>PERT</b>	Deterministic	Probabilistic	Activity oriented	Event oriented	Single time	Three time estimate	<p>5x 1/2</p> <p>Explor: 3 1/2</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: center;">6</p>	<p>2 1/2</p>	
<b>CPM</b>	<b>PERT</b>											
Deterministic	Probabilistic											
Activity oriented	Event oriented											
Single time	Three time estimate											

	Time and cost both are controlling factors	Time only is the controlling factor and the cost is assumed proportional to the project duration			
<p>II.3</p> <p>Tender notice:-Name of work, location, Designation of officer, last date of availability and time for submission, EMD, SD, cost of tender, cost and time period of work etc.</p> <p>Tender documents:-                      Opening of Tender:-Date &amp;Time, Venue, Officer etc.                      Comparative statement:-                      Acceptance of tender:-                      Work order:-                      Contract agreement:-</p>			<p>4x1 1/2 = 6</p> <p>3</p> <p>3</p>	<p>6</p>	
<p>II.4</p> <ul style="list-style-type: none"> <li>All measurements should be recorded neatly and accurately in the M'book by the assistant engineer at work site itself.</li> <li>No Copying the measurement from a note book is allowed.</li> <li>All measurements must be recorded in ink. The contents column shall always be filled in ink.</li> <li>No blank page or blank line is a allowed.</li> <li>Each set of measurements shall begin with some essential endorsements.</li> <li>At the end of measurements, contractors signature must be obtained under the statement of "I accept measurements"</li> </ul>			<p>6x1 = 6</p>		
<p>II.5</p> <p>Welfare includes anything that is done for the comfort and improvement of employees and is provided over and above the wages. The followings can be done</p> <ul style="list-style-type: none"> <li>Dormitories with basic amenities.</li> <li>Locker facilities for storing clothing etc., not used while at work.</li> <li>Screening films on educational industrial/safety measures and social topics.</li> <li>Supply of food stuffs and other provisions at concessioner rates.</li> <li>Subsidized transport arrangement to and from worksite.</li> <li>To raise living standards of the work force and achieve higher productivity skill up gradation through suitable raining is of utmost importance.</li> </ul>			<p>6x1 = 6</p>		
<p>II.6</p>	<p>Method of procurement:-Procure new or old equipment</p>				

<p>II.7</p>	<p>expenses.          Out turn.          Contract time and project time.          Field operating conditions.          Weather.          Owner ship expenses          Operating costs          Ownership expenses include the following</p> <ul style="list-style-type: none"> <li>➤ Major repairs Painting Over hauling</li> <li>➤ Depreciation Interest Taxes</li> <li>➤ Storage and insurance Operating costs include Loading Transporting Fuel Lubricants Servicing and minor repairs</li> <li>➤ Operating crew.</li> </ul> <p>• Every large construction project should have a safety department headed by an officer.</p> <p>• Safety measures as a clause in the contract document.</p> <p>• Previous safety record of a contractor is an important consideration in the pre qualifications of contractor.</p> <p>• Safety is a cost item and no worth -while programme can be developed without providing finds for it.</p> <p>• Safety education and training is one of the more important aspects of construction industry.</p> <p>• Government also needs to improve the safety measures by providing proper inspection. Necessary legislations are to be made.</p> <p>• It is also necessary that contractor and trade unions shall extend their concern to safety.</p> <p>• Safety measures should start at the planning and designing.</p> <p>• It is also necessary that contractor and trade unions shall extend their concern to safety.</p> <p>• Safety measures should start at the planning and designing.</p>	<p>3</p> <p>3</p>	<p>6</p>	<p>8 x 3/4 = 6</p>
<p>III.a</p>	<p style="text-align: center;">PART C</p> <p style="text-align: center;">UNIT I</p> <p><b>Planning:</b>-Formulation of a number of alternative plans for achieving desired objectives and final selection of plan. It is a thinking process before any action.</p> <p><b>Scheduling:</b>-Putting the final plan in a calendar. It shows the duration.</p> <p><b>Organising:</b>-Its principle is division and coordination.</p>			

**Staffing:**-It is the provision of people to fill the positions so created. Recruiting the right persons, training etc.

**Directing:**-Training and guiding sub ordinates to carry out the work assigned tasks and supervising the works.

**Controlling:**-It is necessary for ensuring effective and efficient working. It involves a constant review of the work plan to check on the actual achievements and discover and rectify deviations through appropriate corrective measures.

**Co-ordinating :**-It is necessary to bring together and co-ordinate the work of various departments and sections. This requires an efficient system of communication so that each department and section is aware of its role and the assistance to be expected from others.

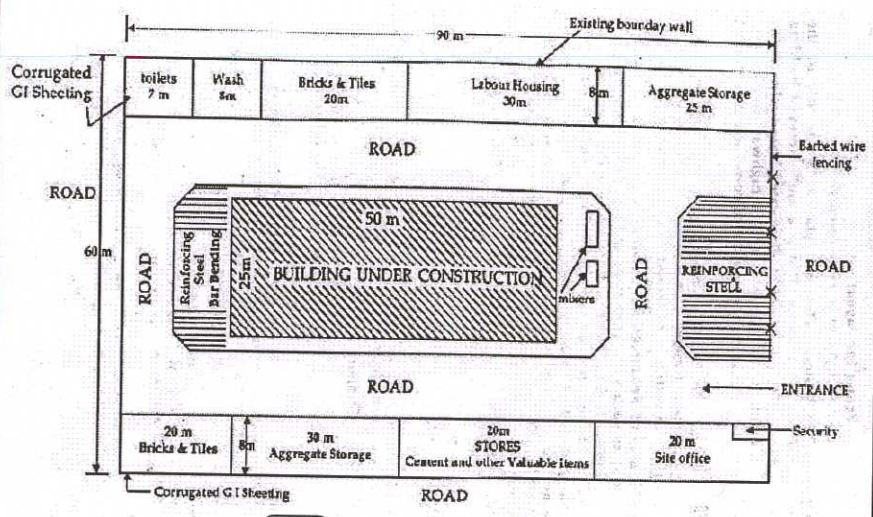
6x3/4 8

III. b

A Job layout planning and optimization on site can reduce the transportation flows, moving, reloading, and enhancing the services of the construction work to improve the work productivity and thus the costs of a project.

Job layout is a scaled drawing of proposed construction site showing all the relevant features such as entry and exit points to the site, contractors' offices, storage areas for materials areas for keeping equipment such as bar bending area, mixers, labor housing, toilets, Washing facilities etc

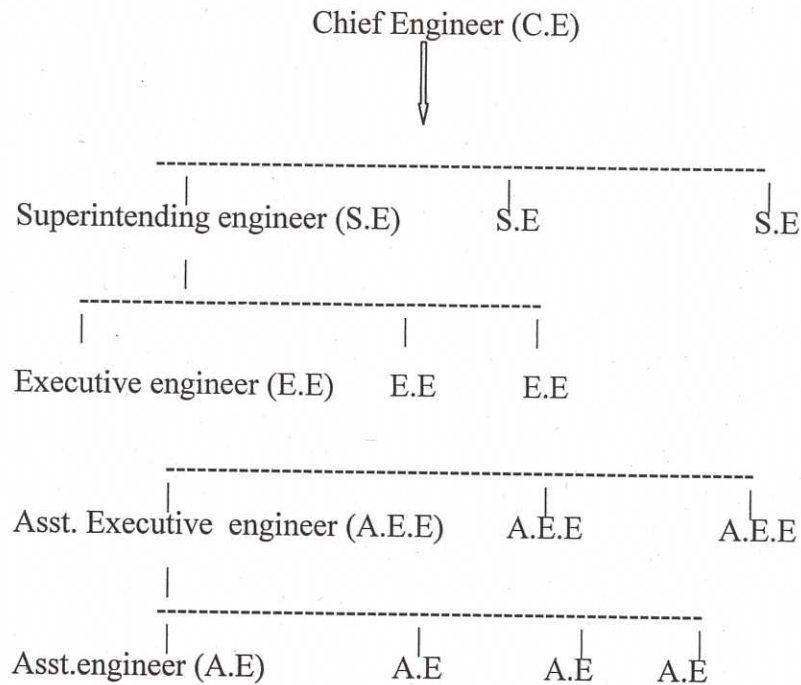
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Job Layout for a Multi Storeyed Building

4 7

IV. a



**Duties of Executive engineer**

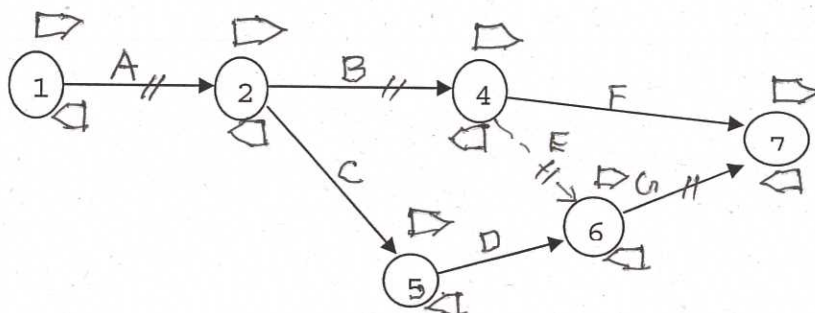
- He ensures that all the works in his division are covered by proper sanction and budget allotments are made.
- He has to prepare completion report for works ar.d close the account for such works.
- Checks the structural stability of all government building in his jurisdiction and provide, for repairs if necessary.
- Conducts check measurement
- Fix the rent for buildings

4

4

8

IV.b



**Activity:-** It is the operation which consumes resources and time

**Event:-** It represents a stage point.

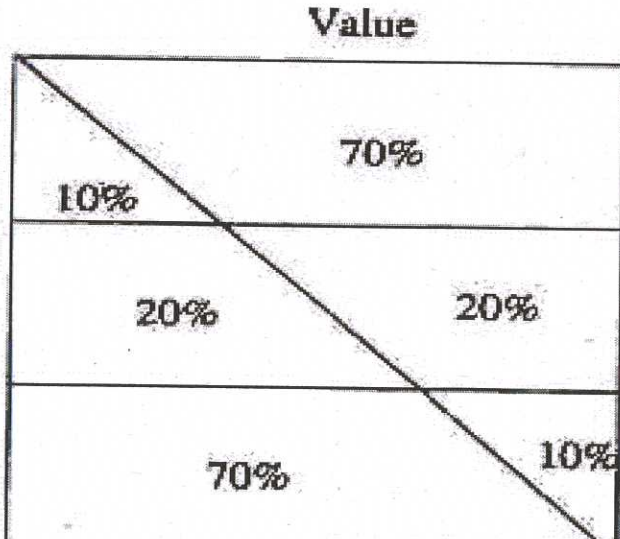
**Dummy activity:** It indicates the sequences and relation between activities only. It does not consume any resources and time.

3.

V.a	<p><b>Critical path:</b>-It is the longest continuous route connecting with critical activities starting from end event. It determines the completion time.</p> <p style="text-align: center;">UNIT II</p> <p><b>Item Rate Contract</b></p> <p>In this type of contract the contractor undertakes the work on item rate basis. The payment is done on the basis of quantities of items done and their respective rates.</p> <p><i>Merits :</i></p> <ol style="list-style-type: none"> <li>1. The additions and alterations in the plan a specifications can be easily made at any stage:-.</li> <li>2. As the contractor gets the payment for the actual quantities, there is no possibility for ex: payment.</li> <li>3. The work can be started after accepting the tender without waiting for all the detailed drawings.</li> <li>4. This method is used in Irrigation projects, construction of big bi and repairs of buildings.</li> </ol> <p><i>Demerits :</i></p> <ol style="list-style-type: none"> <li>1. The total cost of work can only be calculated after completion of work. Finance controlling is very difficult.</li> <li>2. Detailed measurements are very necessary for making payments.</li> <li>3. Great care should be taken for the strict follow of specification and cost controlling.</li> </ol> <p><b>Lump sum contract</b></p> <p>Lumpsum contract consists of execution of specific work completely with all its attendant items fully within the stipulated time for a fixed amount of payment as per the specification prescribed.</p> <p><i>Merits:-</i></p> <ol style="list-style-type: none"> <li>1. Due to competition among contractor accepts the cost of project can be reduced</li> <li>2. As the total cost of the work can be known prior to work. So the department can arrange everything.</li> <li>3. Contractor can complete the work as early as possible.</li> <li>4. Materials can be arranged in systematic way.</li> <li>5. Payments can be made as per prescribed stages.</li> </ol>	2	7	
		2		
		2		

<p>V.b</p>	<p><b>Demerits:-</b></p> <ol style="list-style-type: none"> <li>1. As the plan and specifications are fixed before hand, therefore it becomes very difficult to adjust the additions and alterations in the plan and specifications at later stage.</li> <li>2. In the case of in accurate drawings and specifications it may lead to difficulties and defective construction.</li> <li>3. The owners aims to get the maximum workouts of money he spends where as the contractor tries to get the maximum profit out of the money he receives.</li> </ol> <p><b>Types of bill :-</b></p> <p><b>First and final bill ( F &amp; F bills) form 24 P.W.D.:-</b> This form should be used for making payments both to contractors for works and to suppliers where a single payment is made for a job or contract on its completion.</p> <p><b>Running account bills :-</b> This form used for contracts both for works execution on piece work and for supplies received. This form widely used specially for medium sized works executed through K-2 contract or split up works executed through K-2 contract or split up works or projects entrusted nomination to a number of contractors. Part bills are prepared in white forms and the final bill is made on a yellow form.</p> <p><b>Lumpsum contract bills:-</b></p> <p>In the L.S contract method a number of intermediate payments (i.e.) advance payments are made in Lump sum contract running account bill form before final payment is made the bill will show the value of measured items of works executed, forming part of contract.</p> <p><b>Hand Receipt :</b></p> <p>Hand receipt is a simple form of voucher intended for small miscellaneous payments and advance for which none of the above is suitable. No agreement is necessary for payments made through H.R. Form</p> <p><b>Recoveries From Bill :-</b></p> <ul style="list-style-type: none"> <li>➤ Recovery for advance payment</li> <li>➤ Recovery for departmental materials issued to the contractor on cost recoverable basis.</li> <li>➤ Hire charges for departmental tools and plants lent to</li> </ul>	<p>2</p> <p>2</p> <p>2</p> <p>2</p>	<p>8</p>	
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	<p>contractors.</p> <ul style="list-style-type: none"> <li>➤ Amount to be withheld toward security deposit.</li> <li>➤ Recovery toward penalty for slow progress.</li> </ul>	8	8
<p>VI. b</p>	<p><b>Specifications :</b> A specification is a statement list the details of the job to be carried out. Specifications : of two types:-          General Specifications          Detailed Specifications</p> <p>Specifications are specific statements regarding construction requirements. Basically these requirements should be limited to the necessary technical details pertaining to the structures itself. Specifications and drawings serve the following functions.</p> <ul style="list-style-type: none"> <li>• Description of the proposed work in sufficient detail.</li> <li>• Guidance for building in contracts.</li> <li>• Serve as a base for construction process</li> <li>• Legal instruments to serve as evidence in case of disputes.</li> </ul>		
<p>VII. a</p>	<p style="text-align: center;">UNIT III</p> <p><b>Earth moving equipments and its specific use</b></p> <ul style="list-style-type: none"> <li>• Tractors: To push or pl of load                  Crawler                  Wheel tractor</li> </ul>	7	7
<p>VII.b</p>	<ul style="list-style-type: none"> <li>• Bulldozer:-Cutting and pushing the materials over relatively short distances.</li> <li>• Graders:- Reshaping</li> <li>• Scrapers:-Scrap the ground and load it simultaneously.</li> <li>• Shovel:-Excavation of all classes of earth and discharging into dumpers.</li> <li>• Drag line:-To excavate earth or material below the machine level and load into hauling units.</li> <li>• Cam shell:-Combination of drag line and crane.</li> <li>• Dredgers:-Excavation from river bed.</li> </ul>	8x1	8

<p>VIII.a</p>	<p>workers.</p> <ul style="list-style-type: none"> <li>To cultivate the good culture and team spirit.</li> <li>To help each other.</li> </ul> <ul style="list-style-type: none"> <li>To help the organization to attain its goals</li> <li>Effective utilization and maximum development of human resources.</li> <li>To respect of human beings</li> <li>To ensure reconciliation of individual goals with the organization</li> <li>To achieve and maintain high morale</li> <li>To provide the organization with well trained and well motivated employees.</li> <li>To identify and satisfy the needs of individuals.</li> <li>To develop and maintain a quality of work life.</li> <li>To calculate the team spirit Etc.</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li><i>The functions of HRM can be broadly classified into two categories (i) Managerial functions and (ii) Operative functions</i></li> </ul>	<p>7x1</p>	<p>7</p>																
<p>VIII. b</p>	<p>ABC and VED analysis are the inventory control techniques which occupies the control position in the material management.</p> <p>It is not advisable to pay equal attention to all items inventory.</p> <p><b>ABC Classification</b></p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td colspan="3" style="text-align: center;"><b>Value</b></td> </tr> <tr> <td style="text-align: center;"><b>A</b></td> <td style="text-align: center;">10%</td> <td style="text-align: center;">70%</td> <td></td> </tr> <tr> <td style="text-align: center;"><b>B</b></td> <td style="text-align: center;">20%</td> <td style="text-align: center;">20%</td> <td></td> </tr> <tr> <td style="text-align: center;"><b>C</b></td> <td style="text-align: center;">70%</td> <td></td> <td style="text-align: center;">10%</td> </tr> </table>		<b>Value</b>			<b>A</b>	10%	70%		<b>B</b>	20%	20%		<b>C</b>	70%		10%	<p>8x1</p>	<p>8</p>
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<b>B</b>	20%	20%																	
<b>C</b>	70%		10%																

Classification Category	Percentage of the Number of Items	Percentage of Annual Consumption Value
A	10	70
B	20	20
C	70	10

### ABC Analysis

All items in use, are classified in respect to importance to their total value of annual consumption.

10%-15% of the Items account for 70% of total annual consumption value of all items - these are termed as 'A' class items.

About 15%-20% of items account for 15%-20% of the total annual consumption value of all items - these are termed as 'B' class items.

The remaining approximately 10% of the items are -classified as 'C' items.

'A' Class items are subjected to highest level of control supervision and management.

'B' Class items are subjected to medium level of control, supervision and management.

'C' Class items usually are not subjected to elaborate control/management. Since the cost of effort is not worth it.

For 'A' and 'B' class items, precise mathematical models for determination of economic order quantity (EOQ), frequency of purchase; safety stock/buffer stock level etc. can be used.

### VED Classification

The classification, i.e. VITAL, ESSENTIAL and DESIRABLE is done on the basis of importance of an item to the production process.

Those which are highly important and whose non-availability may render the stoppage of production are classified as 'V', whereas those because of which, if not available, the production may be affected or hampered are classified as 'E' and others classified as 'D'.

5

2 7

IX.a	<p style="text-align: center;">UNIT IV</p> <ul style="list-style-type: none"> <li>• He should know the actual need of the society for the products or services.</li> <li>• He should take up the venture with the spirit of service to the society.</li> <li>• He should work hard to improve better management</li> <li>• He can support to large industries.</li> <li>• He should be successful example in self employment.</li> <li>• He should plan to promote more labour to reduce the unemployment problem.</li> <li>• Full dedication</li> <li>• Greater integrity and reliability.</li> </ul>									
IX.b	<p><b>Elements of TQM</b></p> <ul style="list-style-type: none"> <li>• <b>Leadership</b> –Top management vision, planning and support</li> <li>• <b>Employee involvement</b> –All employees assume responsibility for inspecting the quality of their work.</li> <li>• <b>Product/Process Excellence</b> –Involves product design quality and monitoring the process for continuous improvement.</li> <li><b>Continuous Improvement</b> –A concept that recognizes that quality improvement is a journey with no end and that there is a need for continually looking for new approaches for improving quality.</li> <li>• <b>Customer Focus (on “Fitness for Use”)</b></li> <li>• <b>Design quality</b> -Specific characteristics of a product that determine its value in the market place. <ul style="list-style-type: none"> <li>• <b>Conformance quality</b></li> </ul> </li> <li>• The degree to which a product meets its design specifications.</li> </ul>									
X.a	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 45%;">Managerial Style</th> <th style="width: 50%;">Entrepreneurial Style</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Takes up the Tasks are taken up after an industry is launched.</td> <td>Starts an industry without any experience.</td> </tr> </tbody> </table>		Managerial Style	Entrepreneurial Style	1	Takes up the Tasks are taken up after an industry is launched.	Starts an industry without any experience.			
	Managerial Style	Entrepreneurial Style								
1	Takes up the Tasks are taken up after an industry is launched.	Starts an industry without any experience.								

8x1

8

7x1

7

2	Experience makes balanced attitude.	Over all confidence
3	Conventional methods	Utilises the resources rationally and more economically.
4	Ambition normal	Has fairly strong ambition.
5	May not be necessary in all cases	Needs training to know various details like raw materials equipment, market conditions, sales and government assistance
6	Cannot change production abruptly and sticks to conventional methods	Adopts new techniques and produces new commodities as per the requirement of buyer.
7	Generally avoids any risk.	Takes certain amount of risk.
8	Sufficiently experienced	Has to refine some psychological characteristic inherent in individual.

8x1 8

X.b

ADVANTAGES OF ISO 9000

1. It is suited to the requirement for global export/tender and increases access to global supply to large indigenous companies.
2. Becoming an effective marketing strategy and provides decisive edge over competition. It also helps in acquiring new customers.
3. It increases consistently dependable processes less field failures less wasted time, materials, an efforts and reduction in scrap and rework.
4. Return on investment being achieved is less than two years. For a manufacturing assembly shop.
5. The ISO 9000 standards are capable of helping in defining the current state of total quality management.

- Increased marketability
- Reduced operational expenses
- Better management.
- Increased customer
- Improved internal
- Improved customer
- Reduction of product-liability
- Attractiveness to investors

4

DISADVANTAGES OF ISO 9000

1. Quality assurance is not written for any specific industry. Therefore each individual system has to interpret these guidelines to their own system's requirement.
2. These models are generic in nature and are intended to apply to

	<p>all industries or to every activity.</p> <p>3. Every industry has to consider it as generic in nature, so some people take it as a great source of wisdom.</p> <p>4. It does not dictate the method of implementing the requirements.</p> <p>5. These standards are applicable in contractual situations when conformance to specified requirement is to be assumed during all stages of production cycle.</p> <p>-----</p>	3	7	
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