



SUMMER – 13 EXAMINATION

Subject Code: **12243**

Model Answer

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q1. Attempt any THREE of the following:

i) 1.Job Production:

A Production system which manufactures one or few numbers of single products as per the customer specifications within the fixed time period is known as job production system. **1M**

Examples : special car manufacturers, special machine tool products, computer assembly section, etc. **1M**

2.Batch Production :

When a firm manufactures limited number of products in terms of lots or batch either at regular intervals or according to customer order, it is termed as batch production. **1M**

Examples : chemical plants, pharmaceuticals, paints, electric motors, heavy vehicles, etc. **1M**

ii) Factors Influencing Selection of Site -:

- 1) Availability of raw materials
- 2) Proximity to the market



- 3) Labor supply
- 4) Transport and communication facilities
- 5) Fuel and power
- 6) Climatic considerations
- 7) Momentum of an early start
- 8) Personal preferences
- 9) Government Policy (any 4 points 1 mark each with explanation)

iii) Steps involved in Process Planning -:

- 1) Study of part drawings and its specifications. (part print analysis)
- 2) To decide about make or buy about the part under planning. This decision is called make or buy decision.
- 3) Selection of most appropriate process which is competitive and economical.
- 4) Deciding the sequence of operations which comprises the selected process. Operations are combined wherever possible.
- 5) Determination of blank size of raw material and list of material is prepared.
- 6) As per the capacity and capability, the suitable machines with accessories are selected.
- 7) Determination of inspection points or stages on product manufacturing line.
- 8) Selection of labour, tools, measuring and inspection devices.
- 9) Estimation of process and manufacturing cost of product.
- 10) Preparation of route and operation sheet which is also called as process sheet.

(8 steps for 4 marks)

iv) 1. Routing :

Routing is the selection of route or path over which each part is to travel during the process of transformation from raw material to finished product.

2. Sequencing:

The selection of the appropriate order in which waiting customers may be served is called sequencing.

It is deals with the situations in which the effectiveness measure (time, cost, distance etc) is a function of the order or sequence of performing a series of jobs (tasks).

3. Scheduling:

Scheduling may be defined as the fixation of time and date for each operation as well as it determines the sequence of operations to be followed.

4. Dispatching:

Dispatching is defined as the physical release of work authorization to the operating facilities in accordance of planned routing and schedule. **(1mark each)**

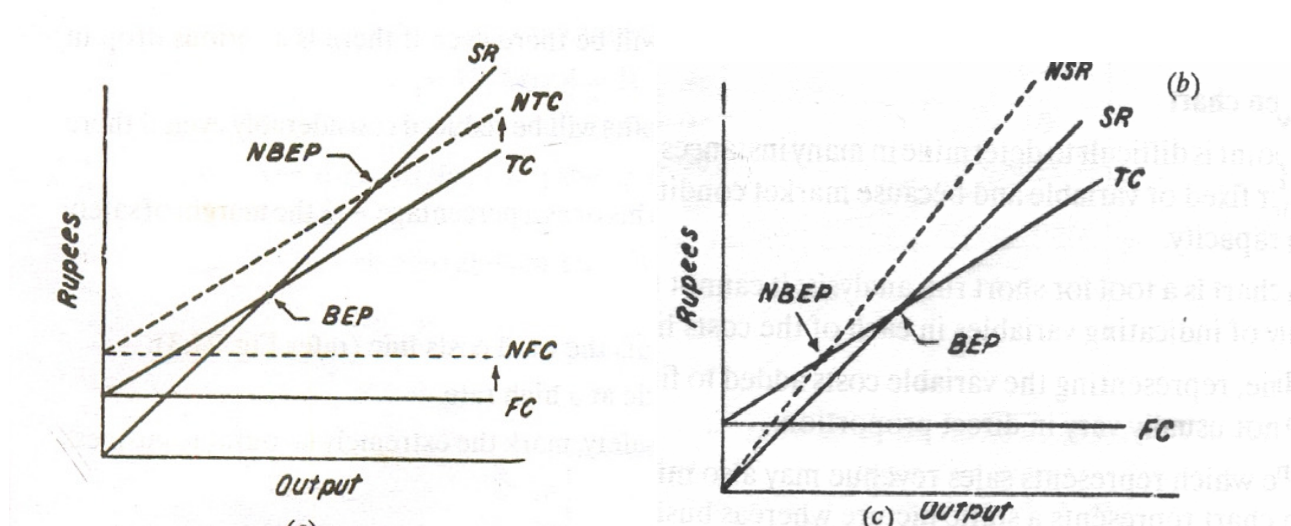
Q1 b. Attempt any ONE of the following:

i) Break even point can be lowered by,

1. By decrease in fixed cost.
2. By decrease in variable cost.
3. By increase in selling price.

Effect of Break-Even Point shifting:

- i. If BEP lowered then Profit Increases
- ii. if BEP Rising then Profit Decreases.



(2+2+2 marks)

ii) Principle Objectives of production planning and control: (4 marks)

1. To plan the production activities in a systematic way to fulfill the production demands.
2. To provide the men, machines, materials and tooling at the right time in the required quantity and quality.

3. To select the path that should be followed by the material.
4. To determine the sequence of operations to be performed.
5. To co-ordinate the workings of different departments.
6. To ensure that the finished product is delivered as per the commitment.

They are achieved by doing or controlling the following parameters. (2 marks)

Materials, Methods, Machines and Equipments, Routing, Estimating, Loading and Scheduling
Dispatching, Expediting, Inspection, Evaluating.

Q2. Attempt any TWO of the following:

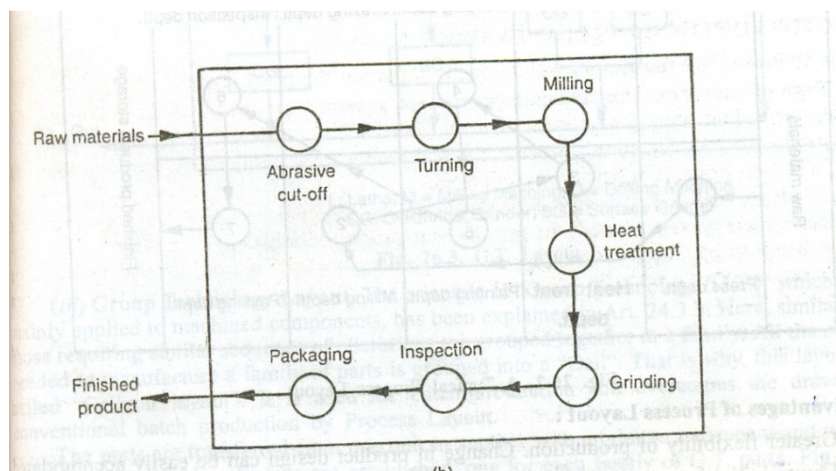
a) Product Layout :-

This layout is also called flow-line layout, line layout or production line layout. In this layout, the machines, equipment and work centers are arranged in a straight or curved line, in the order in which they have to be used, that is, according to the sequence of operations needed to manufacture a product. To justify the product layout, the product must be standardized and manufactured in large quantities. Hence, this system is best suited for mass production.

Examples are : automobile assembly lines, bottling plant and so on.

The raw material enters at one end of the line and moves from one machine to another in the line without back-tracking or cross-movements and finally the end product leaves from the other end of the line.
(2 marks)

Schematic diagram:(2 marks)



Advantages :-



1. Reduced total production time.
2. Minimum of handling and transportation resulting in lower total material handling cost.
3. Less floor area needed per unit of production.
4. There in less work-in-process (WIP), that is, lower stocks.
5. Reduced delays due to the flow of work in the forward direction.
6. Higher productivity.
7. Easy supervision, easy inspection and easier co-ordination.
8. Better utilization of machines and workers.
9. Greater simplicity of production control leading to lower accounting cost and need for fewer controls and records. **(2 marks)**

Disadvantages :

1. The layout is fixed, that is, if the product changes, the whole line will have to be rearranged, that is, lower flexibility.
2. The break down of a single machine in the line leads to shut-down of the whole production line.
3. The manufacturing cost rises if the volume of production falls.
4. If one or more lines are running light, there is considerable machine idleness.
5. Line balancing is important, so that the material being processed, does not have to wait for the next operation.
6. High capital investment.
7. Expansion is difficult. **(2 marks)**

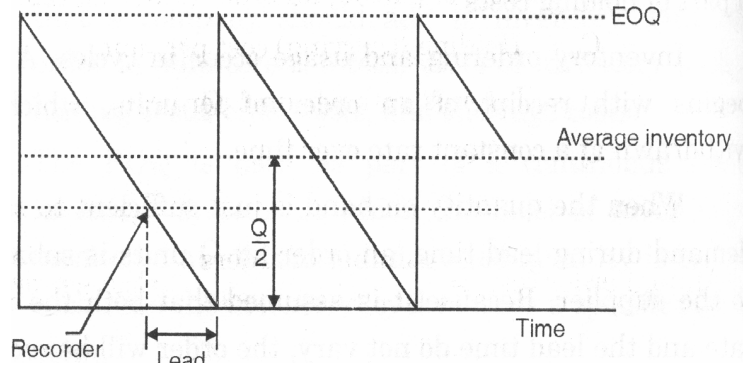
b) EOQ :

The Economic Order Quantity (EOQ) is the number of units that a company should add to inventory with each order to minimize the total costs of inventory such as holding costs, order costs, and shortage costs.

2marks

EOQ model:

- i)Economic order quantity (EOQ) with constant demand and instantaneous supply.



3 Marks explanation 1 Mark for diagram.

Concept of discounts: (2Marks)

Quantity discounts are price reduction for large orders offered to customers to include them to buy in large quantities.

If quantity discounts are offered, the buyer must weight the potential benefits of reduced purchase price and fewer orders that will result from buying in large quantities against the increase in carrying costs caused by higher average inventories. The buyer's goal with quantity discounts is to select the order quantity that will minimize total cost, where total cost is the sum of carrying cost, ordering cost, and purchasing cost:

$$T_c = \text{carrying cost} + \text{ordering cost} + \text{purchasing cost}$$

$$\text{Total cost} = \frac{A \times C_o}{Q} + \frac{Q \times C_{u i}}{2} + C_p \times A$$

Where C_p = purchase price of material per unit.



iii)

| Element | Average time | Rating | Basic time = Average time X Rating/100 |
|------------|--------------|--------|---|
| 1 | 1.44 | 120 | 1.728 |
| 2 | 2.61 | 120 | 3.132 |
| 3 | 3.35 | 120 | 4.02 |
| 4 | 1.21 | 120 | 1.452 |
| 5 | 0.53 | 120 | 0.636 |
| Total Time | | | 10.968 |

(calculating Average time 2 marks)

* Basic time per piece= 10.968 minutes -----1 **(2marks)**

*Relaxation allowance = $5/100 \times 10.968$

= 0.5484 minutes -----2 **(1 mark)**

*Contingency allowance = $3/100 \times 10.968$

= 0.3290 minutes -----3 **(1 mark)**

*Special and other allowances = $8/100 \times 10.968$

= 0.8774 minutes-----4 **(1 mark)**

*Standard time of operation = $1+2+3+4$

= $10.968+0.5484+0.3290+0.8774$

Standard time of operation =12.72 minutes **(1 mark)**

Q3. Attempt any FOUR of the following.

a.

1. The general level of education is an important factor in national productivity. The use of computers and other sophisticated equipment and system requires better educated employees.
Government can help by sponsoring more education, especially in fields that directly affect productivity.



2. Employees need to be motivated to be productive. Pay is not enough; they need to have good, safe, working conditions and to be recognized as the most vital part of the enterprise.
3. Labour unions and management may be adversaries in negotiating pay and benefits but can cooperate in seeking productivity improvements, to the benefit of all.
4. An excessive amount of government regulation may have a detrimental effect on productivity.
5. Government can do much to eliminate unneeded regulations and to make cost-benefit analysis to determine the necessary regulations such as those on health and safety.

(4 Marks)

b. Group Technology –

Processes are grouped into cells using a technique known as group technology (GT).

Group technology involves identifying parts with similar design characteristics (size, shape, and function) and similar process characteristics (type of processing required, available machinery that performs this type of process, and processing sequence) .

Group technology is a manufacturing philosophy or principle with far reaching implications.

(2Marks)

Differing points of cellular layout:

1. Reduced material handling and transit time
2. Reduced setup time
3. Reduced work-in-process inventory
4. Better use of human resources
5. Easier to control
6. Easier to automate **(Any 4 points 2 marks)**

c. Design Principles of Jigs and Fixtures:

1. The jig and fixture should be as open as possible to minimize chip or burr accumulation and to enable the operator to remove the chips easily with a brush or an air jet.
2. Fool Proofing
3. Clearance
4. Rigidity
5. Trunnions
6. Burr grooves



7. Ejectors
8. Inserts
9. Design for safety
10. Sighting surfaces
11. Simplicity in Design
12. Economical **(any 4 points 1 mark each)**

d. Selection of Machine –

1. Initial, running and maintenance cost of machine. A machine which results in lower total cost should be selected.
 2. Volume of production rate of production and unit cost of production.
 3. Type of product to be manufactured and the frequency of production cycle.
 4. The degree of flexibility desired in production.
 5. Durability and dependability i.e. quality and reliability aspect of machine and its output.
 6. Minimum setup, put-away and operation time.
 7. Longer productive life of machines or equipment.
 8. Functional versatility i.e. ability of machine to perform more than one function.
- (any four 1 mark each)**

e. 5 'S' as Waste Reduction Techniques –

Seiri is the first step of the 5S method. It means “to sort” or organize.

Seiri has two main goals :

- 1.Remove unnecessary objects
- 2.Reduce waste

What does it means to “reduce waste” to us. This goes beyond simply “reducing waste material” by identifying all hindrances and generating ideas for improvements. Are work instructions available, accurate, and used Work instructions can help improve quality, reduce reject rates and increase productivity.

What safety hazards exist? Cluttered floors; missing safety guards on machinery; electrical faults; broken steps on ladders.



1.Are materials being waster?

2.Will employees become ill?

3.Do we have the right tools, in the right places, in good condition?

Waste reduction techniques should be key components of any cost-effective, comprehensive waste management program. They do not have to be based on complex technology or require large capital expenditures. **(4 marks)**

| Que.4 | Attempt any THREE of the Following (3*3=9) | Marks |
|--------------|---|-------|
| a.(i) | Name the material handling devices suitable for process layout and explain any one. List of material handling devices suitable for process layout any 4 type. (2 M) | 04 |
| Ans: | i) Trucks a) Power lift - fork lift truck - elevating platform truck b) Hand lift truck c) porters trolley ii) Tractors and trailers. iii) Hoist and cranes iv) Conveyor Explanation of above any one –(2 M) Trucks: - Manually operated trucks are most commonly used for movement of material over short distance where the load are not heavy. - Most commonly used trucks are fork lift truck. - Heavy duty machines having diesel or petrol engine with large wheel are used for stockyard work. - Trucks with smaller wheels are used for both operations inside & outside. | |
| ii) | What are the different types of assembly? Explain any one. | 04 |
| Ans: | Types of assembly (2 M) i) Unit assembly/ fixed assembly/ stationary assembly | |



| | | |
|------------------------------------|---|----|
| | <p>ii) Progressive assembly</p> <p>Explanation of any one type (2 M)</p> <p>i) <u>Unit assembly/ fixed assembly/ stationary assembly</u></p> <ul style="list-style-type: none">- In unit assembly the complete joining of two or more part is carried out at a single place- The complete product is assembled at a single assembly work station. <p>ii) <u>Progressive assembly</u></p> <ul style="list-style-type: none">- In progressive assembly the components moves along the assembly line and at each work station few components are joined to the parts or sub assembly. | |
| <p>iii) Ans:</p> | <p>Explain plant capacity and plant efficiency factor.</p> <p>Plant capacity (2 M)</p> <ul style="list-style-type: none">- Plant capacity is the amount of finished product or final product produced per hour- Generally plant capacity is expressed as amount of final product produced per annum <p>Plant efficiency factor (2 M)</p> <ul style="list-style-type: none">- It is the ratio of the working hours utilized by the plant per day or per shift or per week or per year to the working hours of the plant for the same period- Plant efficiency factor = $\frac{\text{actual work hour in sp. Period}}{\text{available work hour for sp. Period}}$ | 04 |
| <p>iv) Ans:</p> | <p>What is the LOB? With suitable example</p> <p>LOB (line balancing)-Concept (2M)</p> <ul style="list-style-type: none">- Line balancing means assigning the equal work content to each work station in the assembly line.- The main objective of line balancing is to minimize idle time of man and machine <p>Proper Explanation with example (2M)</p> <ul style="list-style-type: none">- If a product is completed by using three different machines – A,B & C in sequence.- If ‘A’ can process 10 pieces / unit time,- If ‘b’ can process 15 pieces / unit time &- If ‘C’ can process 30 pieces / unit time.- Then for line balancing, 3 machines of type A, 2 machines of type B with every | 04 |



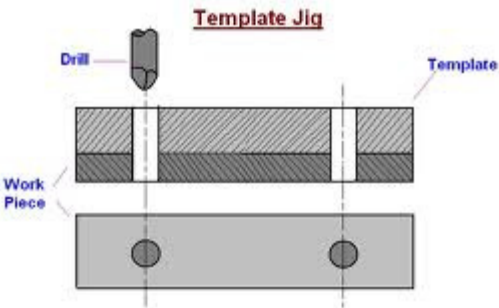
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| | machine of type C. So that constant output of 30 pieces / unit time at each work station can be achieved. | |
| Que.4 b i) Ans: | <p>Define machine capacity. Explain the factor affecting the machine selection.</p> <p>Machine capacity: Definition-(2M)</p> <ul style="list-style-type: none">- It is production rate of machine per hour- Capacity is expressed in terms of unit produced per hour or tones per annum. <p>Factors affecting machine selection (any 4 point- 4 M)</p> <ul style="list-style-type: none">- Types of product.- Types of plant layout.(Space requirement)- Running and maintenance cost.- Quantity to be produced.- Durability & Reliability.- Flexibility.- Minimum setup & operation time.- Ease in operation. | 06 |
| ii) Ans: | <p>Explain the principle of material handling.</p> <p>A) Related to planning (any 2 point- 2M)</p> <ul style="list-style-type: none">- All activity should be planned.- Plan a system which include all the handling activities & co-coordinating the operations.- Simplification principle.- Gravity principle.- Space utilization.- Safety principle. <p>B) Related to equipment (any 2 point- 2M)</p> <ul style="list-style-type: none">- Mechanization/ automation principle.- Equipment selection according to movement & method of material handling.- Standardization principle.- Flexibility principle.- Maintenance principle.- Idle time principle- reduced idle time. | 06 |



| | | |
|--------------------------|---|----|
| | C) Related to Operation (any 2 point- 2M) <ul style="list-style-type: none">- Control principle- Use material handling equipment to improve production control, inventory control etc.- Capacity principle- to achieve full production capacity.- Performance efficiency principle. | |
| Que.5 | Attempt any <u>FOUR</u> of the Following (4*4=16) | |
| a) Ans: | <p>State the advantages and limitations of rapid prototyping.</p> <p>Advantages: (Any 4 point – 2M)</p> <ol style="list-style-type: none">1. The Prototype gives the user a fair idea about the final look of the product.2. Rapid prototyping can enhance the early visibility.3. It is easier to find the design flaws in the early developmental stages.4. Active participation among the users and producer is encouraged by rapid prototyping.5. As the development costs are reduced, Rapid prototyping proves to be cost effective.6. The user can get a higher output.7. The deficiencies in the earlier prototypes can be detected and rectified in time.8. The speed of system development is increased. It is possible to get immediate feedback from the user.9. There is better communication between the user and designer as the requirements and expectations are expressed in the beginning itself.10. High quality product is easily delivered by way of Rapid prototyping. <p>Disadvantages: (Any 4 point – 2M)</p> <ol style="list-style-type: none">1. Some people are of the opinion that rapid prototyping is not effective because, in actual, it fails in replication of the real product or system.2. It could so happen that some important developmental steps could be omitted to get a quick and cheap working model. This can be one of the greatest disadvantages of rapid prototyping.3. Another disadvantage of rapid prototyping is one in which many problems are overlooked resulting in endless rectifications and revisions.4. One more disadvantage of rapid prototyping is that it may not be suitable for large sized applications.5. The user may have very high expectations about the prototype's performance | 04 |



| | | |
|--------------------------|--|----|
| | <p>and the designer is unable to deliver these.</p> <ol style="list-style-type: none">6. The system could be left unfinished due to various reasons or the system may be implemented before it is completely ready.7. The producer may produce an inadequate system that is unable to meet the overall demands of the organization.8. Too much involvement of the user might hamper the optimization of the program. | |
| b) Ans: | <p>Define Method Study. State its objectives.</p> <p>Definition:2 M</p> <p>Method study: Method study may be defined as the systematic investigation of the existing method of doing a job in order to develop and install an easy, rapid, effective and efficient procedure for doing the same job and at lower costs.</p> <p>Objectives : (any 4 points- 2 M)</p> <ol style="list-style-type: none">1. Improvement in process and procedure.2. Improvement of factory shop and work place layout.3. Improvement of the design of plant and equipment.4. Reduction of unnecessary fatigue and economy in human effort.5. Improvement in the use of materials, machines and manpower6. The development of better working environment. | 04 |
| c) Ans: | <p>"Critical examination forms the basis for the method improvement." Justify.</p> <p>Critical examination is a questioning technique having a set of questions to find out the facts and reasons, six types of question are framed- what, why, how, when, where and who. The questioning process is considered under five major heads namely- place, purpose, sequence, person and means. These five aspects are considered as governing factor in critical examination.</p> <p>All the questions are divided into three categories :</p> <p>(a) Primary questions: deals with facts and reasons.</p> <p>(b) Secondary questions: deals with finding out the alternatives.</p> <p>(c) Final questions: select few alternatives for development.</p> <p>Thus, it is clear that solution to above questions will definitely give an idea for developing new method to some difficult problem. Thus, critical examination is a motive force to develop new method.</p> | 04 |

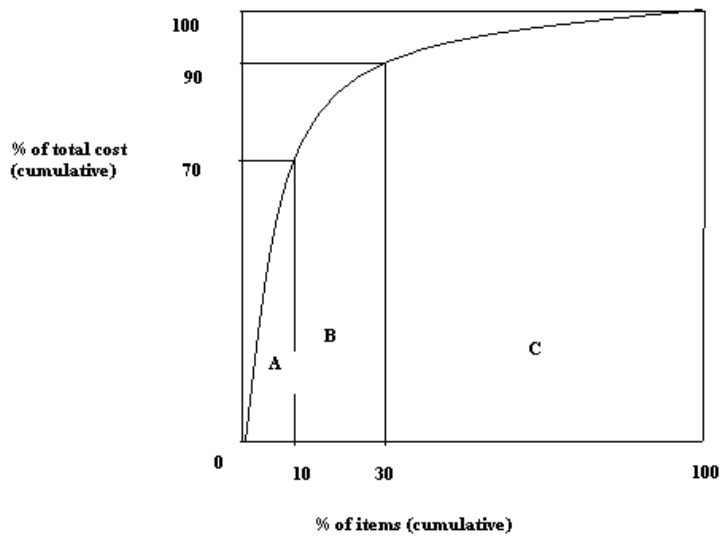
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| <p>d)</p> <p>Ans:</p> | <p>What are the different types of jigs and fixtures? Draw a neat sketch of any one jig and label it.</p> <p>Types of jigs : (1 M)</p> <p>a) Drill jigs:</p> <div style="display: flex; justify-content: space-between;"> <p>i) Template jig.</p> <p>ii) Plate jig.</p> </div> <div style="display: flex; justify-content: space-between;"> <p>iii) Diameter jig.</p> <p>iv) Leaf jig.</p> </div> <p>v) Channel type jig.</p> <p>b) Boring jig.</p> <p>Types of fixture: (1M)</p> <div style="display: flex; justify-content: space-between;"> <p>i) Milling fixture.</p> <p>ii) Turning fixture.</p> </div> <div style="display: flex; justify-content: space-between;"> <p>iii) Grinding fixture.</p> <p>iv) Broaching fixture.</p> </div> <div style="display: flex; justify-content: space-between;"> <p>v) Boring fixture.</p> <p>vi) Indexing fixture.</p> </div> <div style="display: flex; justify-content: space-between;"> <p>vii) Welding fixture.</p> <p>viii) Assembly fixture.</p> </div> <div style="display: flex; justify-content: space-between;"> <p>ix) Tapping fixture.</p> <p>x) Duplex fixture.</p> </div> <p>Neat sketch of any one type of jig with lable: 2 M</p> <div style="text-align: center;">  </div> | <p>04</p> |
| <p>e)</p> <p>Ans:</p> | <p>Explain two bin system.</p> <ul style="list-style-type: none"> - One of the oldest systems of inventory control is the two- bin system. - In the two bin system, stock of each item is separated into two bins. - One bin contains stock; just enough to last from the date of new order is placed until it is received in inventory. - The other bin contains a quantity of stock, enough to satisfy probable demand during the period of replenishment. - To start with, the stock is issued from first bin. When the first bin is empty, an order for replenishment is placed, and the stock in the second bin is utilized until the ordered material is received. | <p>04</p> |
| <p>f)</p> | <p>State the necessity of material requirement planning.</p> | <p>04</p> |



| | | |
|--|---|----|
| Ans: | (any 4 point- 4 M) Necessity of MRP: <ul style="list-style-type: none">I. It helps to procure the material or components as and when needed and thus excessive inventory levels.II. To ensure availabilities and procurement of materials as well as action required to meet delivery deadlines.III. Using MRP, it is possible to give timely information about likely delivery times to prospective customers.IV. It helps to increase the efficiency of production system. | |
| Que.6 a) Ans: | Why power devices are used in clamping ? What are the disadvantages in hand clamping? Reasons (any 4 point- 2 M) Power devices are used in clamping because of following reasons: <ul style="list-style-type: none">- It holds the work piece rigidly.- The work piece not be damaged due to application of clamping pressure by the clamping unit.- It is capable to be unaffected by the vibrations generated during an operation.- It is user friendly, like it's clamping and releasing is easy and less time consuming.- It is quick acting & easily controllable.- Reliable & high accuracy. Disadvantages of hand clamping. (any 4 points- 2 M) <ul style="list-style-type: none">- Variable pressure damages the work piece.- More time required for clamping.- Due to repetitive effort of operator, operator's fatigue comes into play.- Uniform clamping pressure for similar type of element is difficult to achieve.- Less accuracy due to improper clamping. | 04 |
| b) Ans: | Define single piece production system. State its correlation with JIT. Definition of single piece production system. (2M) Single piece production system describes the sequence of product or of transactional activities through a process one unit at a time. In single piece production system, focus is on the product or on the transactional process, rather than on the waiting, transporting and storage. Correlation with JIT : (Proper explanation : 2 M) Achieving single piece production system helps manufacturers achieve the just –in – | |



| | | |
|----------------------------------|---|----|
| | <p>time manufacturing.</p> <p>That is right parts can be made available when they are needed in the quantity they are needed.</p> <p>Single piece production means parts are moved through operations from step to step with no Work-in-Process (WIP) in between, either one piece at a time or a small batch at a time. That satisfies the JIT requirement.</p> | |
| <p>c) Ans:</p> | <p>What are the general steps for conducting the time study?</p> <p>The various steps involved in time study procedure are as follows:</p> <ol style="list-style-type: none">1. Select the task to be timed.2. Standardized the method of working.3. Select the operator to be studied.4. Record necessary details of job and condition of work.5. Break the task into elements.6. Measure the duration of each element and check the pace of working.7. Extend the observed time into normal/ basic time.8. Calculate the standard time after adding the various allowances with normal time. | 04 |
| <p>d) Ans:</p> | <p>What is ABC analysis? Explain with neat sketch.</p> <p>(Concept- 1M , sketch 1M, Explanation-2M)</p> <p>ABC analysis: ABC analysis is segregating the items from one another and tells how much valued the items is and controlling it to what extent is in the interest of organization.</p> | 04 |



ABC analysis furnishes following information:

- A-items are high valued items but are limited or few in numbers. They need careful and close inventory control.
- B-items are medium valued items and their number lies between A and C. Such items need moderate control. They are more important than C-items and also required careful storage and handling.
- C-items are low valued but maximum number of items. These items do not need in any control, rather controlling them is uneconomical. They are generally procured just before they finish.

e)

Draw two handed process chart for filling ink in a pen.

04


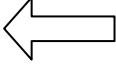


| | | | | | |
|--|--------|--------|---------------------------|-------------|--|
| Task: Filling up ink in a fountain pen | | | | Charted by: | |
| Chart begins: Move to take pen | | | | Charted at: | |
| Chart ends: Screwing the barrel to the pen top | | | | Charted on: | |
| Left hand description | Symbol | Symbol | Right hand description | 3 M | |



| | | | | | | |
|--|--|--|--|--|-----------------------|--|
| | <p>Move to take pen</p> <p>Bring the pen to central position.</p> <p>Holding the pen</p> <p>Holding the pen</p> <p>Holding the pen</p> <p>Taking the pen-top near to ink bottle.</p> <p>Sucking the ink from bottle to pen pump.</p> <p>Holding the pen top.</p> <p>Holding the pen top.</p> | | | <p>Remain idle.</p> <p>Remain idle.</p> <p>Removing the cap & putting it at convenient place.</p> <p>Returning to central position.</p> <p>Unscrewing the barrel of pen.</p> <p>Holding the pen</p> <p>Holding the pen</p> <p>Taking the barrel near the pen - top.</p> <p>Screwing the barrel to the pen-top.</p> | <p>(any 6)</p> | |
| | <p>Summary:</p> | | | | <p>1 M</p> | |



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| | |  |  |  |  | | |
| | Left hand | 1 | 3 | 5 | - | | |
| | Right hand | 3 | 3 | 2 | 2 | | |